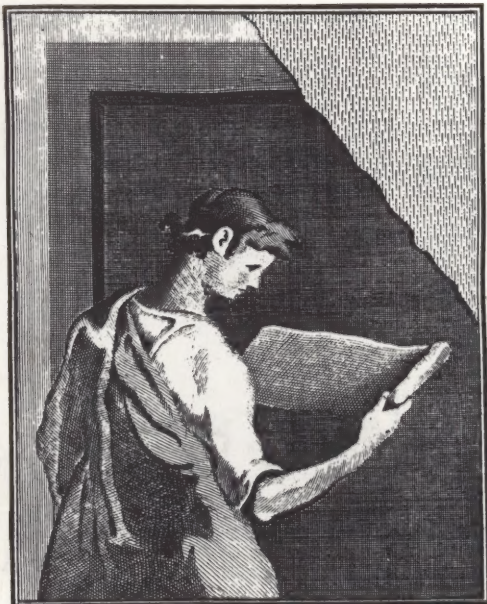


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PHOTOGRAPHIC ENLARGING

By
R. CHILD
BAYLEY.

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PHOTOGRAPHIC ENLARGING



Photographic Enlarging

A Handbook for Amateur Photographers.

By R. CHILD BAYLEY

Author of "The Complete Photographer," etc., etc.,
Editor of "Photography & Focus."

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PREFACE.

NO other photographic process has increased in popularity in the course of the last few years to so great an extent as enlarging, chiefly direct enlarging on bromide paper. This has been brought about by the perfection of the hand camera and by the introduction of what are truly pocket cameras, which occupy little more room in the pocket than a purse or cigar case, but will yield beautifully sharp little negatives, capable of enlargement up to 15×12 in., or more. The demands of the hand-camera worker have led to the introduction of new patterns of enlarging apparatus, which in turn have increased the use of hand cameras, until we reach a state of things in which almost every photographer uses enlarging in some form or other, and more than seventy-five per cent. of the photographs at exhibitions are enlargements.

The most popular handbook, "Practical Enlarging," by the late John A. Hodges, being now out of print, and no very recent work having made an appearance to take its place, the need of something on the subject to supplement the useful but necessarily brief booklets issued by the trade was manifest; and the constant touch with photographers of all grades into which the author is brought as Editor of *Photography and Focus*, not only revealed the need of a book to which enquirers could be referred, but gave a good idea of the scope and extent it should possess. Hence the present volume.

Lest any would-be enlarger should be led to imagine that he must master a handbook of 165 pages before he

PREFACE—(continued).

can hope to understand his subject, it may be pointed out that if he reads the introductory Chapter I., and then either Chapter II. if he intends to take up daylight enlarging, or Chapters III. and IV. if he means to work by artificial light, he will have the groundwork of enlarging, so far as it differs from contact printing, and can consult the other chapters later.

The author has to thank Mr. H. W. Bennett for assisting him with the illustrations, and Messrs. Butcher and Sons, Ltd., Houghtons, Ltd., Kodak, Ltd., J. Lancaster and Son, Ltd., the Midland Camera Co., the Westminster Photographic Exchange, Ltd., and Messrs. J. and A. Wilkinson for the loan of blocks.

The fact that enlarging is merely a form of photographing, and that the enlarging apparatus is only a modified camera, has been dealt with rather fully at the outset, so that the reader's knowledge of ordinary photographic work can be brought to bear at once upon the new branch he is considering—a line which correspondence with many beginners has suggested as being advisable. At the same time, the author trusts that the later portions of the book will be found useful to those for whom the introduction is quite superfluous.

R. C. B.

THE TEMPLE, *October*, 1910.

CHAPTER I.

Introductory.

ENLARGING IS SIMPLY PHOTOGRAPHING.—THE ESSENTIALS OF AN ENLARGER.—FOUR DIFFERENT TYPES OF ENLARGING APPARATUS.—DAYLIGHT ENLARGERS.—DAYLIGHT ENLARGING IN A DARKENED ROOM.—ENLARGING WITH A LANTERN.—ENLARGED NEGATIVES.—THE CHOICE OF APPARATUS.

ENLARGING is merely re-photographing. The small negative from which an enlargement is required is simply photographed on to a piece of bromide paper or other similar sensitive substance ; and, since in photography two negatives make a positive, the negative of the original negative is a positive print, and the size of that print is governed by exactly the same laws as governed the scale of the picture when the original negative was made. So that an enlarger is neither more nor less than a camera.

Every photographer knows that the larger he wants the objects in his picture to appear, the nearer he goes to them ; and that the nearer he goes, the more he has to increase the distance between the lens on the camera and the plate in order to get them sharp ; until at last, when the plate is the same distance from one side of the lens that the objects are from the other, the image of those objects on the plate is the same size as the objects themselves. If he goes still nearer, and extends his camera still more, the size of the image goes on increasing, so that it is larger

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than the original ; and, provided his apparatus will allow of sufficient extension, there is no limit to the size of picture which can in this way be produced.

It does not want a " powerful " lens, or any mysterious optical combinations, to produce a huge enlargement. The same lens which will make one a quarter-plate size would make one of the size of an acre if we could get a camera or box big enough to hold it, and adjusted the original negative at the right distance.

An enlarger, then, in essence, consists of an arrangement for holding the negative that is to be enlarged, and a lens and a camera for photographing it. It may be provided with means for illuminating the negative and with all sorts of adjustments for holding the plate or paper on which the enlargement is to be made, and so on ; but essentially it is merely a camera and a negative holder. It is well that this should be made quite clear at starting, as it will save explanations later on ; since, by putting enlarging on all fours with ordinary photography, it will make the reader's knowledge of such photography applicable at once to his enlarging.

There are several designs of enlarging apparatus, but they may all be classed under four heads. The first is the daylight enlarger, shown diagrammatically in figs. 1 and 2. Here the negative is at N, the lens at L, and the bromide paper at P. The true camera, therefore, is the part shaded, and marked C ; the enclosure between the lens and the negative being made merely to hold the negative steadily, and to keep stray light from striking the lens. It is not absolutely necessary that that part of the enlarger

INTRODUCTORY.

should be light-tight ; it serves the same purpose which, in ordinary photography, is served by shading the lens. Fig. 1 is what is called a fixed focus daylight enlarger, the relative positions of negative, lens, and paper being fixed

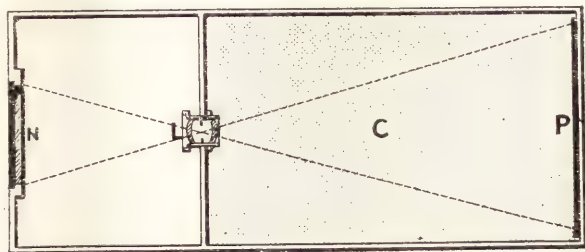


Fig. 1. Fixed focus daylight enlarger.

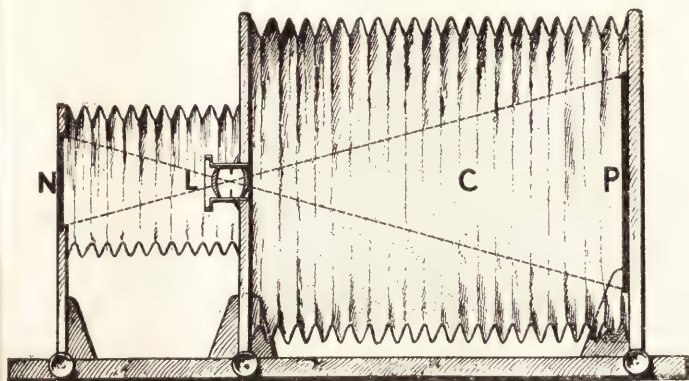


Fig. 2. Focussing daylight enlarger.

once and for all, so that the degree of enlargement is unalterable. Fig. 2 is a focussing daylight enlarger, the bellows and rackwork allowing the distances of the negative and paper from the lens to be adjusted ; so that, in this,

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the degree of enlargement is limited only by the stretch of the bellows of the camera part. In enlargers of both these kinds, the negative to be enlarged is usually illuminated by daylight, although, as will be seen later, artificial light is not out of the question.

In fig. 3 we have quite a different form of enlarger, although the principle is the same. Here daylight is used, but the entire workroom forms the camera, so that much

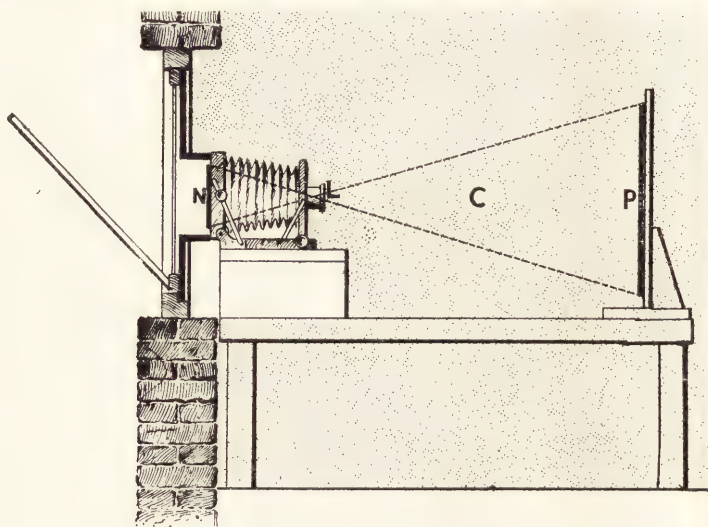


Fig. 3. Daylight enlarging in the dark room.

larger pictures can be made than in any bellows instrument. The photographer's camera, which can be seen on the left, is only used to keep the light coming through the negative from getting out into the room, except through the lens; the true camera, it must not be forgotten, is the room

INTRODUCTORY.

itself. This is a form of enlarging apparatus mostly used by those who make enlargements professionally ; but it is equally applicable by the amateur, when he has a room which can have its window darkened and a reflector, as shown, fitted outside.

The fourth form of enlarging apparatus is a very popular one. Here again (fig. 4) the entire room forms the camera, so that large pictures can be made if required, the lantern and its accessories being merely the arrangements by

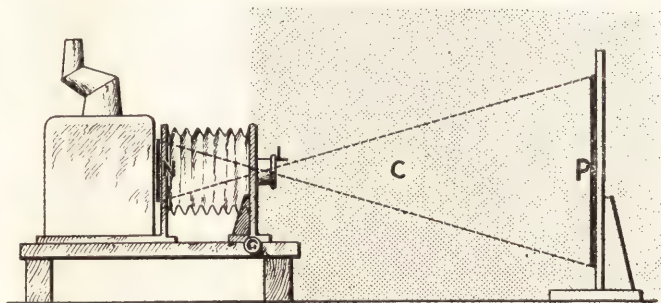


Fig. 4. Enlarging with a lantern.

which the negative and lens are held, and the former is illuminated. For enlarging by artificial light, this is the most convenient form of apparatus.

The simplest of these arrangements is the fixed focus daylight enlarger, and for that reason its use will be dealt with first. For many purposes it will do all that is required ; and being, moreover, by no means an expensive piece of apparatus—a very good one can be bought for much less than ten shillings—it serves very well for a beginning.

The sensitive material used in enlarging is generally "bromide paper." This is paper which has been coated

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with very much the same sort of preparation as that with which the ordinary dry plate is coated, except that the bromide paper "emulsion," as it is called, is not so sensitive. It is usually about the same sensitiveness as a very slow plate ; but, still, this is quite sufficient to make the use of a dark room a necessity, although the room may be illuminated with yellow instead of with red light. The "gaslight" papers, which differ from bromide paper chiefly by being less sensitive, can be used in daylight enlargers ; but they are generally too slow for enlarging by artificial light.

Instead of paper, glass plates may be used. In such a case, instead of the negative, it is customary to use a positive on glass, or a "transparency," as it is called. The enlargement of this on to a plate gives an enlarged negative, from which prints may be made by any of the ordinary printing processes. Some workers make their enlarged negatives on bromide paper instead of on glass plates, partly for economy, and partly because the paper allows a good deal of handwork to be put on it before the prints are made. Such a paper negative takes longer to print than a glass negative does, and the paper gives it a slight grain ; but in an enlargement this does not matter much and the process is quite a practical one.

The development of bromide paper enlargements is exactly similar to the development of bromide paper prints, and does not differ from the development of negatives, except that in the prints and enlargements it is important to get an image of a pleasant colour and to keep the whites pure, which in a negative are points that are unimportant.

INTRODUCTORY

THE CHOICE OF APPARATUS.

The selection of the apparatus for enlarging will be governed partly by the amount to be expended, and partly by the nature of the work to be done. Daylight as the illuminant has the advantage of being very cheap, not merely for the light itself, but for the apparatus for utilising it. The exposures required with it are short, and there is an absence of heat, of smell, and of complications, sometimes met with when enlarging by means of artificial light. On the other hand, the strength of daylight is constantly varying, so that steps have to be taken to measure the light each time, if waste of paper is to be avoided. Another objection to its use, and an important one to the amateur photographer, is that, unless the arrangement shown in fig. 3 is adopted, the photographer cannot stand beside the sheet of bromide paper while it is being exposed, and by shading parts of it, while allowing other parts to print out, modify the results very considerably. This power is one which is most useful at times, as will be seen later on. Again, much of the amateur's enlarging is done at night when daylight is not available, and when daylight enlargers can only be used by a kind of makeshift.

On the other hand, the artificial light enlarger, or enlarging lantern, costs a good deal more, running into pounds where the other runs only into shillings. When the negatives to be enlarged are themselves large, say half-plate size or over, the enlarging lantern becomes a very cumbrous affair ; and, if the exposures are to be short, it becomes very costly. For the ordinary run of hand camera negatives, however, it is the most all-round useful pattern ; and the chances are that the amateur who starts

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with a daylight enlarger will ultimately get an enlarging lantern for his work.

It ought to be made quite clear that the pattern of apparatus selected does not affect the quality of the enlargements in any way. The cheap daylight enlargers will turn out just as good enlargements as the most costly and elaborate patterns. The lenses in them do not need to be very perfect, as their imperfections can be cured by the use of a small stop. The more expensive patterns are better, in that they are more convenient, enable parts of the negatives to be selected for enlargement, allow distortion to be remedied, and if fitted with a good lens permit the exposures to be shortened, and give other advantages. But, so far as the quality of the work done in them is concerned, there need be no apparent difference between the cheapest and the most costly.

CHAPTER II.

Daylight Enlarging.

FIXED FOCUS DAYLIGHT ENLARGERS AND THEIR USE.—
MAKING THE FIRST ENLARGEMENTS.—THE FACTORS
WHICH GOVERN EXPOSURE.—FINDING THE CORRECT
EXPOSURE BY TRIAL.—DAWSON'S DENSITOMETER.
—WORKING INDOORS.—FOCUSSING DAYLIGHT EN-
LARGERS.—THE LENS FOR ENLARGING.—ENLARGING
IN THE DARK ROOM.—A VERTICAL ENLARGER.

THE fixed focus daylight enlarger has already been shown in outline form in fig. 1. It is made in a good many patterns, but they are all sufficiently alike to allow them to be dealt with together. In its simplest design (fig. 4), the negative is held at one end in a frame by means of clips, or if it is a film negative it is pressed between a couple of pieces of clean glass. The other end is provided with a piece of glass and a light-tight lid. The whole arrangement is taken into the dark room, and a piece of bromide paper is put face downwards on this piece of glass, and the lid is put on. The enlarger is then carried out into daylight, and stood on end, with the negative uppermost, so that the uninterrupted light of the sky may shine straight downwards into it. A little shutter is sometimes provided, which is drawn out to make the exposure, and pushed in again at its completion; and the enlarger being taken once more into the dark room, the bromide paper is taken out and developed. The more expensive forms are furnished with a dark slide to hold the bromide paper, so that there is no need to carry all the apparatus into the dark room; but the principle is the same.

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The first exposures to be made with the enlarger should be upon platino-matt bromide paper for choice, and the developer used may be that which is recommended by the maker of the paper. The use of bromide paper, its develop-

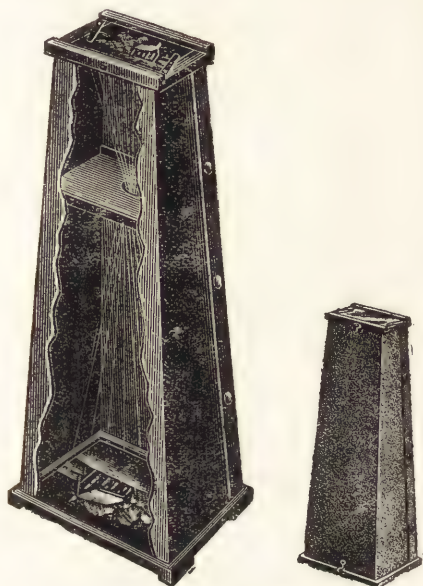


Fig. 4. Fixed focus daylight enlarger.

ment and finishing, are the same, whether the exposures have been made by daylight or with a lantern, and so will be dealt with after the different forms of enlarger have been considered.

The packet of bromide paper having been opened in the dark room and a sheet taken out, that sheet, it will be found, has a tendency to curl. The concave, or inner, side of the curl is the sensitive side, and may be turned towards

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the lens in the enlarger. The negative must be put in the other end, with its film side towards the lens, as otherwise the enlargement will be reversed right for left.

The exposure in enlarging, as in all other photographic processes, is the real crux ; and, unfortunately, it is not possible to give any definite data for the beginner to go upon, for reasons which will appear in a moment.

The exposure in an enlarger is determined by five features. These are—

- (1) The strength of the light at the time.
- (2) The character and colour of the negative.
- (3) The degree of enlargement.
- (4) The stop in the lens.
- (5) The sensitiveness of the bromide paper used.

Some of these factors do not vary much. For example, in a fixed focus enlarger, the degree of enlargement and the stop in the lens are always the same, although as the size of the stop is never given by the maker, and is not easily ascertained, the exposures with one enlarger can only be compared with the exposures with another by trial. Still one does not often want to do this ; so it is unimportant.

Then, again, by using always the same make of bromide paper, factor No. 5 need give rise to no difficulty. This leaves the exposure to be determined by the negative and the strength of the light.

After a few enlargements have been made, it is not difficult to estimate with the eye the extent to which the negative will affect the exposure. Assuming that the photographer always uses a non-staining developer for his negative work, it is not difficult to compare the negative that is to be enlarged with another, the exposure for which is known.

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Those who prefer it can use a little piece of apparatus known as "Dawson's Densitometer" (fig. 5), in which the light coming through the negative illuminates a screen, while side by side with this screen is another which is

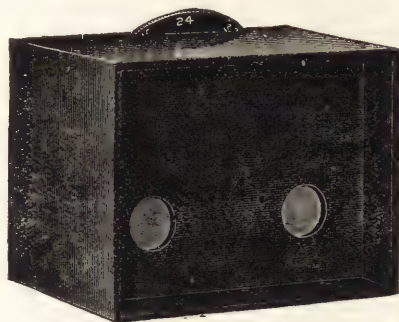


Fig. 5. Dawson's Densitometer.

illuminated by the direct light. This light is cut down by means of stops until the two screens are seen to be evenly illuminated ; and when this is the case, the density of the negative is found by noting the extent to which the light had to be cut down to make the two screens alike.

The real problem of exposure in daylight enlarging, however, centres in the strength of the daylight ; and, fortunately for the photographer, this is capable of direct measurement with an exposure meter. While there are still some photographers who do not believe in the exposure meter for ordinary negative making, there is not room for two opinions as to its value in enlarging. To use it, the meter is placed on or beside the negative, with its sensitive paper turned to face the light, just as the negative will face it during exposure, and the time taken for it to darken

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to the standard tint is noted. At first, at any rate, a little notebook should be kept, and in this should be entered the negative used, the exposure meter time, the exposure actually given, and the result of every enlargement exposed; and in this way, working with a fixed focus enlarger, the exposure problem becomes so far simplified as to be almost non-existent.

So long as negatives of similar density and colour are used, the exposures will be strictly proportional to the times taken for the meter paper to darken. Suppose, for example, we know that a certain negative gave a correctly exposed enlargement with an exposure of fifty-five seconds when the meter paper took twelve seconds to darken to the standard tint. When enlarging with a similar negative we find the correct exposure by measuring the light with the meter. The meter paper this time darkens in nine seconds, let us say. We multiply the known correct exposure by the new meter time, and divide by the first meter time. Thus 45 multiplied by 9 is 405, and 405 divided by 12 is 34 nearly. So that the exposure then necessary is thirty-four seconds.

As the purchaser of a daylight enlarger does not know the value of the stop in it, he must find out the correct exposure at first by trial. To do this, the daylight is first carefully measured with the meter.

There are several patterns of exposure meter on the market. The writer uses a Watkins "Bee," which is very convenient; but any form which is provided with sensitive paper and a standard tint will serve. Exposure meters which merely consist of tables or calculators, without

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any appliance for measuring the strength of the light, are not of any use for this particular purpose.

The light measured, and the enlarger being in position with its negative turned up towards the sky, it should be covered with a card, and the shutter of the enlarging apparatus withdrawn. The card is then taken right away for, say, ten seconds. At the end of that time it is placed so as to cover about an inch of one end of the negative. After the lapse of thirty more seconds it is pushed over another inch. After the lapse of two minutes it is pushed another inch, and after the lapse of eight minutes it is pushed over another inch, the exposure shutter is closed, and the bromide paper is developed.

A little thought will show us that, while the first part of the negative was exposed for 10 seconds, the second part had 40 seconds, the third part 160 seconds, and the fourth part 640 seconds, each successive exposure being thus four times as long as the previous one ; and on developing the paper it will not be difficult to see which of these four is nearest correct. A second trial piece of paper should be exposed in the same way, first of all measuring the light with the meter again ; but in this case, instead of each exposure being four times the last, the difference should not be so great. What is thought to be about the correct time should be estimated from the appearance of the first trial piece, and then this time should be halved. The card should be put in position, and after an exposure of half what is deemed correct, an inch of the negative should be covered. After the lapse of a similar interval another inch is covered, after the same time a third, and again a fourth strip is covered. If the first strip had 15 seconds,

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therefore, we shall have an enlargement which has received 15, 30, 45, and 60 seconds exposure in its different parts ; and it will be easy after developing this to determine what is the precise exposure required by the enlarger with a negative of the kind used.

This may seem a little trouble, and the photographer may feel disinclined to "waste" a couple of sheets of bromide paper on two such exposures, but it will be the simplest in the end, and it is certainly not "waste," but true economy to use the sheets in making a deliberate trial rather than to cast about and try to guess the exposure, which may mean that the first dozen pieces of paper exposed do not give a single satisfactory enlargement.

It is the custom with most makers now to include in each packet of bromide paper a small piece extra, to be used as a test piece. It is very convenient ; but for the first trials with an enlarger it is better to use an entire sheet, as it is not easy to judge from a small piece, at least at first, which is the correctly exposed portion.

In putting out a daylight enlarger to expose, it will not do merely to put it where daylight can fall upon the negative, as one would put out a printing frame. There is a lens well stopped down the other side of that negative, and if there are any well defined objects, such as the sky line of houses or trees, within the range of that lens, they will show in the enlargement, not perhaps as trees or houses, but in the form of irregular illumination of the picture. To avoid this the enlarger is best stood on end, so that there is nothing but uninterrupted sky above the negative. The sun must not be allowed to shine directly upon it ; but, short of this, the more light the better.

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If this position of the enlarger is impossible for any reason, as, for example, when the work is to be done indoors, the sky light may be reflected into the negative by means of a mirror. A mirror of silvered glass is best, if it can be fixed so that it reflects nothing but uninterrupted sky ; but if there is any doubt about that, a sheet of white paper or card, or a piece of white opal glass (a good deal larger than the negative), may be used as the reflector. This will require a much longer exposure than the mirror ; but the risk of uneven illumination is much smaller.

There are more elaborate forms of daylight enlarging apparatus on the market, which allow of different degrees of enlargement being used. Such apparatus generally takes the form of a double camera, as in fig. 6, a large one with a dark slide to take the bromide paper, and a smaller one to enclose the space between the lens and the negative. Some are provided with scales, so that the different degrees of enlargement can be obtained without any need of focusing, the two cameras merely being extended to the proper marks on the scales. Some, again, can have the small camera taken away altogether, and then, by putting another lens on, in place of the enlarging lens, the big camera can be used for ordinary photography.

It may be as well to point out why another lens is necessary in such a case. It has been already shown that the same lens may be used for both small and big enlargements. In fact, any lens which, when it is used in the camera in the ordinary way, will cover a plate the size of the negative that is being enlarged, will do to enlarge that negative to any size we like. Thus, if we have a quarter-plate camera fitted with a lens which covers a quarter-

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plate properly, that lens will do for enlarging quarter-plate negatives to any size desired. It will do just as well for making 24×18 enlargements as for making them 6×4 or smaller, provided only that the negatives which are to

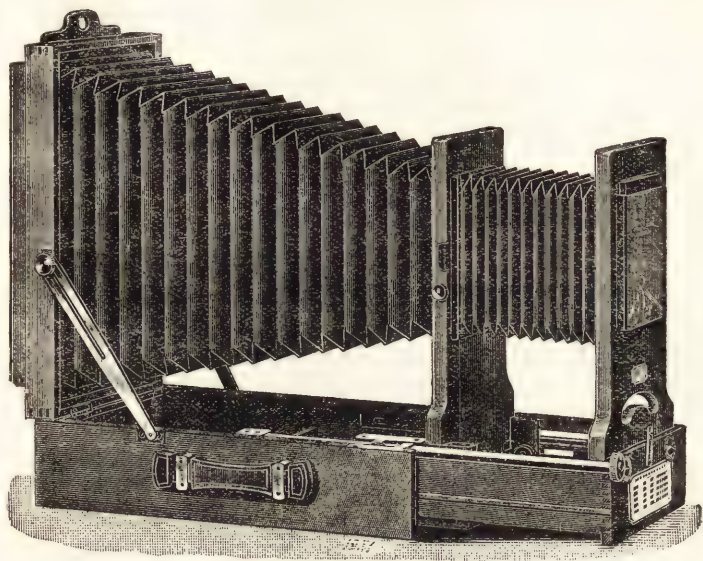


Fig. 6.—Adjustable Daylight Enlarger.

be enlarged are not greater than quarter-plates. But, of course, for ordinary photography, if we have a whole-plate camera we must have a lens that will cover a whole-plate, or if a 12×10 then the lens must cover 12×10 . And so it comes about that when the enlarging camera is used for ordinary negative making, as sometimes it can be, it must be provided with a lens for such work, the lens used for enlarging not being suitable.

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Daylight enlargers of the double camera type are not so easily turned up to face the sky as the smaller and more rigid fixed focus patterns; and as a rule a reflector will be found more convenient with them.

The exposure problem becomes more complex with this form also, since it varies with the degree of enlargement. Although it is not always strictly accurate, it will be found a safe working rule to vary the exposure according to the relative *area* of the enlargements. Thus, if we have made an enlargement in the enlarging camera to whole-plate size, and want to make another, identical in every way with the first, but 15×12 in size, or thereabouts, the exposure given, if the stop is not altered, will be about three and a third times as great, because, while there are 55 square inches in a whole-plate, there are 180 square inches in a 15×12 , and 180 is, roughly, $3\frac{1}{3}$ times 55.

The method is only an approximate one at the best; but in ordinary work it does all that is wanted, and saves going into elaborate calculations, which might give a result a fraction more accurate, but which, besides taking time, give ample opportunity for more serious errors than the simple rule just quoted.

When the whole work room can be darkened easily, except for an opening about the size of the negative, we can use some such arrangement as is shown in fig. 3 for daylight enlarging. The negative may be carried in the frame which usually holds the ground-glass focussing screen of the camera, or another frame made to hold it and to fit in like a dark slide. The shutter which obscures the window must have an opening at least as large as the negative, and outside this a reflector must be fitted. The

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camera is then fixed up against the hole, with its lens pointing into the room, and all light leakage between the back of the camera and the window shutter must be carefully blocked out with a focussing cloth, or in some similar manner. An easel is then set up in front of the lens, and the picture focussed on it, with the aid of the rack and pinion on the camera, and by moving the easel. Easels for enlarging are dealt with in Chapter IV.

When all the enlarging is to be done by daylight, and there is a room which can be set aside for it, this method is very satisfactory ; but there are only a comparative few who can adopt it, and the arrangements are governed so much by the particular conditions of the place in which the work is to be done, that it would be a waste of space to go into the design of such apparatus in any detail. It is convenient to fit the easel on rails, or to hang it from a travelling truck, so that it can easily be moved backwards and forwards, keeping it all the time strictly square with the rest of the apparatus. The lens should have a yellow glass cap so that the picture can be seen on the bromide paper when this is being pinned up, and its exact position arranged accordingly.

A little window, or else a sleeve and a ledge, should be provided, so that when all is ready an exposure meter can be put out, and the strength of the light falling on the reflector tested. With professional enlargers, when the work is being done continuously all day, this is not needed, each exposure serving to test the light for the next ; but the amateur who only enlarges now and again will find it indispensable.

DAYLIGHT ENLARGING.

A very convenient modification of this form of enlarger was described by Dr. D'Arcy Power recently. Fig. 7 will serve to show the general arrangement. It takes the form of a cupboard in the dark room, with its top a skylight,

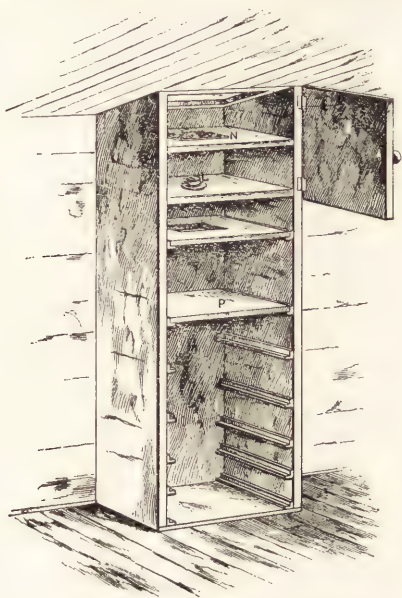


Fig. 7.—Vertical arrangement for daylight enlarging in the dark room.

closed by a piece of plain or ground-glass. Below this is a shelf on which is placed the negative to be enlarged, and below this again is a shelf in which is the lens. Below this are a series of grooves in which a board carrying the bromide paper can be slipped, according to the degree of enlargement required. In Dr. Power's case he used a series of spectacle lenses of different foci on a sort of wheel arrangement which allowed any one to be brought into

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position. This did away with any necessity to vary the distance between the negative and the lens ; but it would be an easy matter to fit the lens in a focussing jacket, or a sliding mount, so as to let one lens serve for all the different degrees of enlargement required. In this arrangement, the camera, of course, with which the negative is photographed, is the space in the cupboard, between the shelf carrying the lens and the board carrying the bromide paper. A full description of the apparatus will be found on page 508 of *Photography and Focus* for June 22, 1909.

These methods of using the dark room itself as the enlarging camera have one great advantage, which they share with the enlarging lantern, in that the photographer can stand beside the paper while it is being exposed, and introduce modifications into the enlargement by shading, vignetting, etc., in a way that is not practicable with the enclosed enlargers. This will be better understood when Chapter VIII. has been read, as this deals with that branch of the subject.

CHAPTER III.

Apparatus for use with Artificial Light.

ENLARGING WITH AND WITHOUT A CONDENSER.—WHY A CONDENSER OR A DIFFUSER IS NECESSARY.—THE RELATIVE ADVANTAGES OF THE TWO METHODS.—THE FUNCTION OF THE CONDENSER.—PARABOLIC REFLECTORS.—HEAT WITH IRIS DIAPHRAGM AND SHUTTER LEAVES: A CAUTION.—THE CHOICE OF AN ILLUMINANT.—THE EFFECT OF THE ILLUMINANT ON THE ENLARGEMENTS.

THERE are two distinct methods of enlarging by artificial light, and as they differ in certain important characteristics, the nature of the difference, which turns on the illumination of the negative, must be considered.

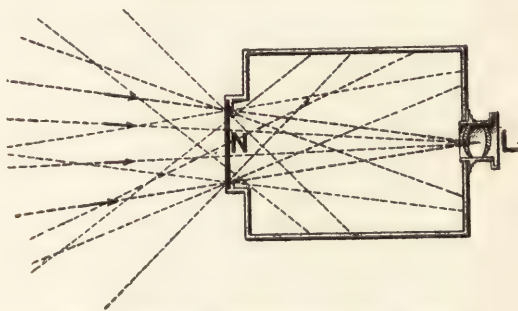


Fig. 8.—Scattered illumination in daylight enlarging.

In daylight enlarging, behind the negative to be enlarged there is an immense source of light, the sky or its reflection, sending rays in all directions through the negative. Such a state of things is represented in fig. 8, where the negative N is seen, with light rays reaching it in all directions, and passing through in towards the lens L. Of these rays, a

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good many strike the interior of the enlarging apparatus and are absorbed ; but some from every part of the negative reach the lens, and, passing through it, go on to the bromide paper beyond and form the picture.

But if instead of daylight a lamp is used, as represented diagrammatically in fig. 9, it will be seen that, although light from the lamp reaches every part of the negative,

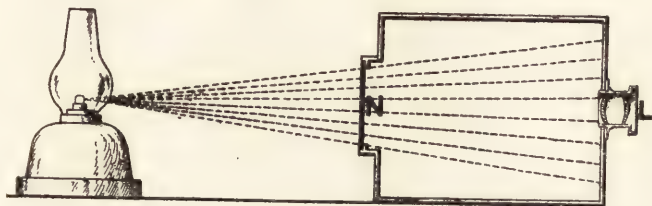


Fig. 9.—Why a lamp only illuminates the centre of the negative.

the only light to reach the lens is what has passed through just that central spot of the negative which lies in a straight line between the source of light and the lens. If an enlargement were attempted with such an illumination, only just the centre of the negative would be enlarged, and the rest would be bare white paper.

It is common knowledge that the action of any such lens as a photographer uses, or of a magnifying glass, is to bend or refract all the rays of light which pass through it, except those which pass through the centre ; and if they proceed from a suitably placed point on one side of the lens to bring them to a focus at a particular spot on the other side of it, as is represented in fig. 10.

Now, if we imagine such a large lens or magnifying glass, larger in fact than the negative to be enlarged, placed close to that negative, with the lamp at a suitable distance

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from it, it is clear that practically the whole of the light which reaches that lens can be refracted so that not only will it pass through the negative as before, but it will reach

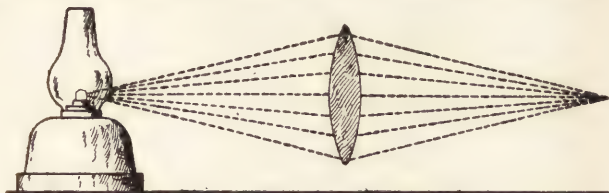


Fig. 10.—The action of a lens in bringing rays to a focus.

the lens beyond. Such a state of things is represented in fig. 11. It will be seen that the action of this lens does not of necessity cause any more light to reach the negative, but it so directs that light that all of it will pass through the lens, and so can be used in making the enlargement. Such a lens is known as a “condenser,” and such an arrangement as is sketched in fig. 11 is that employed when enlarging with a condenser.

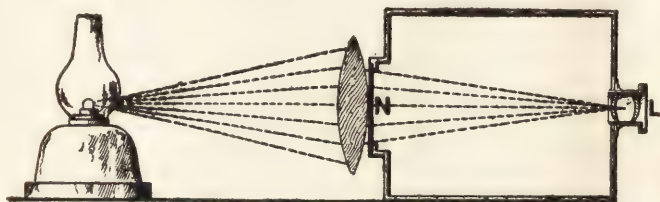


Fig. 11.—The effect of the introduction of a lens in the path of the rays.

The condenser, it is well to remember, just as the enlarging lens itself, is not some subtle and mysterious optical device, but just a lens or magnifying glass, like the ordinary lens of the camera, acting upon the light which falls upon it in precisely the same way, having a definite

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focal length, and differing from the photographic lens chiefly by not being so finely worked or provided with so many "corrections" for giving a sharp image. In enlarging work these corrections are not needed, and so the condenser is generally a comparatively simple lens; although for certain reasons, into which we need not go, it is usually constructed of two separate glasses, with their more curved surfaces turned towards each other (fig. 12).



Fig. 12.
A condenser.

The condenser, it will be seen, has to be larger than the negative that is to be enlarged. This means that for a quarter-plate it must be at least five and a quarter inches in diameter (five and a half is better), while for a whole-plate it must be nearly eleven inches. As such lenses are not merely heavy and cumbrous, but are also, in very large sizes, costly and easily broken by the heat of the illuminant, enlarging with a condenser is limited to comparatively small negatives. The size of the enlargements themselves is, of course, not limited in the same way, but may be anything up to the size of the wall of the room in which the work is being done. Even condensers for quarter-plates are comparatively costly; and so a good many photographers contrive to enlarge by artificial light without a condenser.

How this can be accomplished will be seen on reference to fig. 13. A glance at fig. 9 reminds us that it was only that part of the negative which lay in the direct path between the lens and the light which would show in the enlargement, from which it is clear that if we could get

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a source of light large enough compared with the negative, the whole of the negative could lie in that path, and so be enlarged. When light falls on a matt white surface, the whole surface behaves as if it were itself a source of light.

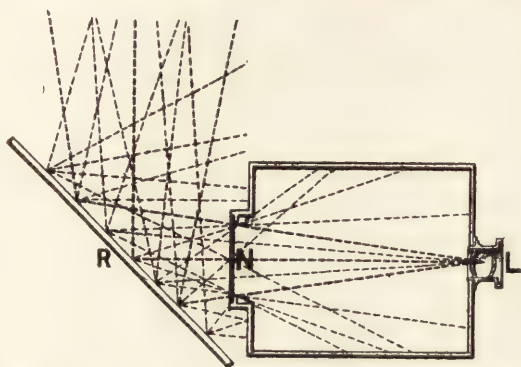


Fig. 13.—The irregular scattering of light by a matt white reflector.

So that if behind the negative we place, say, a sheet of white card, and let the light fall on that, the whole of the negative can be illuminated. Such an arrangement is shown in fig. 13. The white card acts as a "diffuser," scattering light in all directions, and the ultimate effect is very similar to that when diffused daylight is used, as was represented in fig. 8.

There is yet another way. Suppose in the path of the rays in fig. 9 we introduce a sheet of ground-glass (G1, fig. 14), it will scatter the light to some extent. If a second sheet G2 is interposed at a little distance from the first, the scattering will be more perfect, and in this way sufficient light can be sent through the negative in all directions to enable some to reach the lens from every part of it, and thus to impress the bromide paper.

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These different methods are all used, but the condenser is the most popular, for a very good reason. It will be seen that practically all the light which passes through the

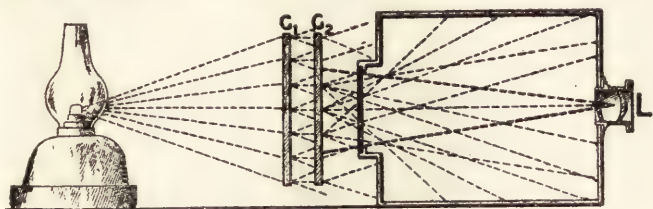


Fig. 14.—The scattering of light by ground glasses.

condenser reaches the lens, except, of course, what is stopped by the image on the negative. The result is that even when a comparatively weak form of artificial light is used, and

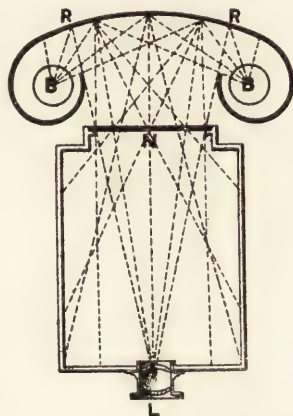


Fig. 15.—Parabolic reflection diffuser (in plan).

the lens of the enlarger is stopped down, the exposures required are not impossibly long. But with diffusers, at the best all that they do is to scatter the light in all directions,

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so that some of it from every part of the negative reaches the lens. The greater part of it is lost. Exposures with diffusers are necessarily long, therefore, unless a very powerful light is used.

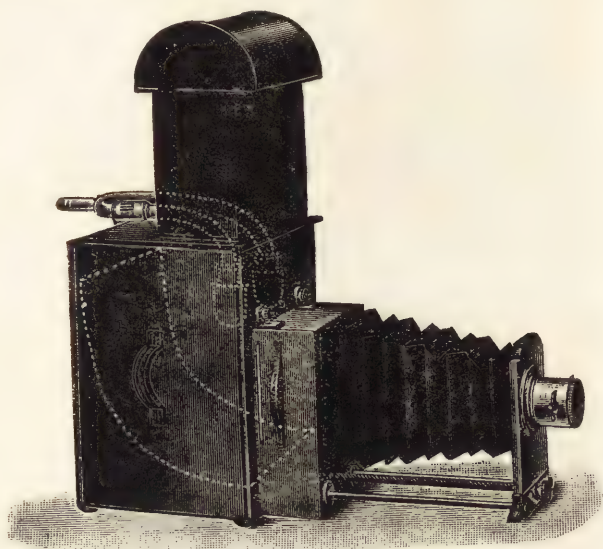


Fig. 16.—Lancaster's Ellipsoid Enlarger.

There are two forms of diffuser which are quite practical, however. One is shown in plan in fig. 15. It has two incandescent gas burners B B, so placed that while none of the direct light from them reaches the negative, the parabolic reflector R R, which is made of metal painted a fine matt white, reflects a great deal of the total light towards the negative N. The lens of the enlarger is shown at L. The other (fig. 16) is similar, but is arranged for a single inverted incandescent gas burner.

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Another form has recently been introduced by Messrs. Marion from the design of Mr. Ralph W. Robinson (fig. 17). Here the negative is surrounded with powerful incan-

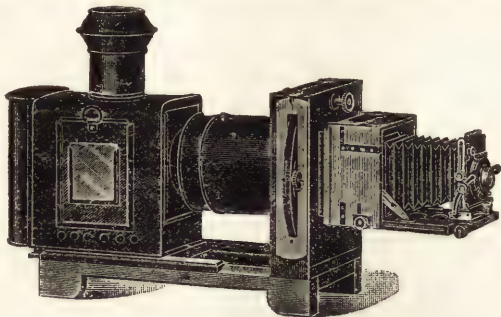


Fig. 17.—Enlarging lantern made to take a camera.

descent electric lights, which illuminate a white reflector, the whole arrangement being enclosed in a light-tight box.

Incandescent gas, which is clean, cheap, and constant, is very popular for enlarging, both with a condenser and with a diffuser. If the latter arrangement is properly constructed, there should be no risk of it getting so hot as to injure the negative or the camera, if this is used as a part of the enlarging apparatus, as it often is. The photographer fits his own camera on the front of the lantern, and the lens with which the negative was taken is used to enlarge it.

Lanterns with condensers are often used in the same way. A typical apparatus of this kind is the "M.C.C. Enlarger No. 7" which is shown in fig. 17. This is made by the Midland Camera Co., a firm which has very largely specialised in enlarging apparatus, and has a number of different models to suit varied requirements.

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The camera and its lens in this takes the place of the bellows and lens of the enlarging lantern. This arrangement has the advantage that when the photographer has a high-class lens on his camera, he can use it for enlarging also, very conveniently. A similar apparatus, but in this case made to take an oil lamp as the illuminant, is shown in fig. 18. This particular instrument is made by Messrs. Butcher, who also supply a very wide range of enlarging apparatus.

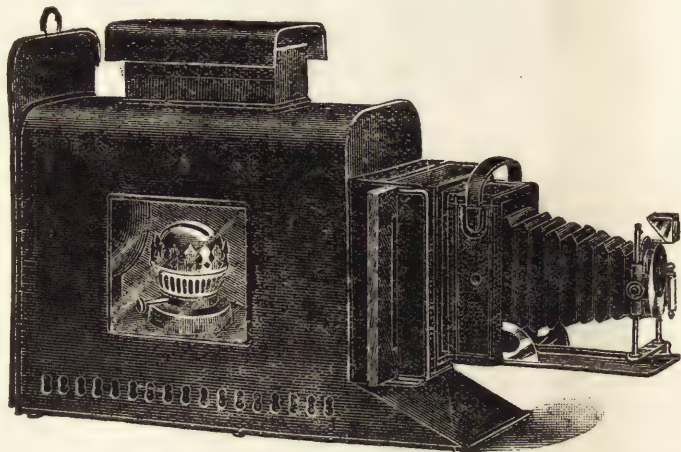


Fig. 18.—Enlarging lantern made to take a camera.

A word of caution is necessary here. Many modern lenses are provided with iris diaphragms or with diaphragm shutters, the leaves of which are made of ebonite. The powerful beam of light from a condenser is not only brilliant but hot, and may cause serious injury to such leaves. When the lens is to be used in such an enlarger, therefore, one should be sure that the leaves are of metal. The best plan

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is to have a spare mount with a metal iris in it, and to screw the lenses into that for enlarging, or else to have a separate enlarging lens altogether.

The illuminant selected for enlarging by artificial light must be decided by circumstances. There are many to choose from, including the electric arc, the electric incandescent, the Nernst electric lamp, the oxy-hydrogen lime-light, incandescent gas, a burner taking methylated spirit and a mantle, acetylene, and the oil lantern.

Of these, the arc light is mostly used by professional enlargers. The Nernst is perhaps the best electric light for the amateur. If current is not available, but gas can be used, then incandescent gas will be found to take a lot of beating ; while where there is neither gas nor current at hand, the oil lantern is the most generally serviceable for enlarging only. Both the spirit-mantle and acetylene are very suitable, and the choice between them and oil must be decided by the preference of the photographer. When the enlarger is to be used for projecting lantern slides, the spirit-mantle or the acetylene burner is to be preferred. Another form of illuminant introduced lately, which gives a fine light for the purpose is the "Petrolite" lamp, in which an incandescent gas mantle is used in conjunction with a flame of petrol and air. The petrol is not carried loose in the container, as this would be dangerous, but the entire reservoir is occupied with a porous stone or brick saturated with the petrol, which therefore cannot be spilled.

The relative strength of the various illuminants used for enlarging cannot be given quite definitely, because it is affected both by the character of the negative and by the aperture of the lens, a small stop with one illuminant pass-

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ing a greater proportion of its light than it might do with another illuminant; but an approximation which will help the photographer to decide upon the one to select is furnished in the following table. Supposing that the exposure with an arc lamp carefully adjusted is represented by one second then:

A Nernst lamp would require about 20 seconds.

An acetylene jet ,, ,, 3 minutes.

A spirit burner and mantle ,, 3 minutes.

Incandescent gas ,, ,, 5 minutes.

An oil lamp ,, ,, 20 minutes.

There is no difference between these various illuminants in the quality of the enlargements which they give. When the negatives used are very vigorous, the strong beam of light from the arc lamp gives a more harmonious enlargement than a weaker light would do; while when they are very soft, the oil lantern gives the best result. But a good average negative can be enlarged satisfactorily by any of them, and the particular method selected must be settled by local conditions and the taste or fancy of the photographer.

CHAPTER IV.

Enlarging by Artificial Light.

THE EASEL.—SIZES OF CONDENSERS.—FOCUSSED.—THE ADJUSTMENT OF THE LIGHT.—THE NECESSITY FOR A LIGHT-TIGHT LANTERN.—TESTING.—THE STOP AND ITS INFLUENCE ON EXPOSURE.—SIMPLIFYING THE EXPOSURE PROBLEM.—THE LENS: RAPID RECTILINEAR OR ANASTIGMAT.—THE USE OF DAYLIGHT ENLARGERS WITH ARTIFICIAL LIGHT.—THE NEGATIVE.

WHETHER a lantern with a condenser or with a diffusing arrangement be employed, some form of easel or

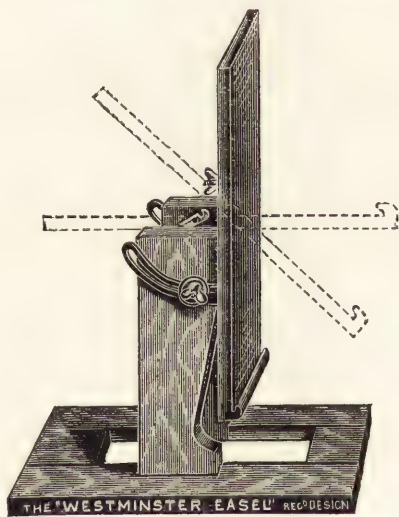


Fig. 19.—The Westminster Enlarging Easel.

support for the bromide paper will be needed. This may be merely a drawing-board fastened on the wall, or it may be

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an appliance like the Westminster enlarging easel (fig. 19), capable of being adjusted in all sorts of ways for purposes which will be dealt with later on. Another well designed easel the "Jaynay," is shown in fig. 20.

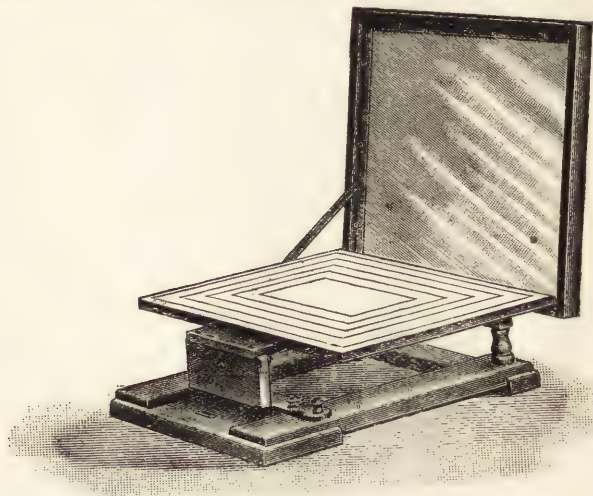


Fig. 20.—The "Jaynay" Enlarging Easel.

The condenser of an enlarging lantern should be distinctly larger in diameter than the diagonal of the plate to be enlarged. Thus the most suitable sizes are: For quarter-plate $5\frac{1}{2}$ in., for $5 \times 4\frac{1}{2}$ in., for postcard size ($5\frac{1}{2} \times 3\frac{1}{2}$) $6\frac{1}{2}$ in., and for half-plate $8\frac{1}{4}$ in. It will be found a distinct improvement to fit a disc of finely ground-glass between the light and the condenser, the most convenient place being close up to the face of the condenser. The illumination is slightly less, but is more uniform. This entirely does away with any trouble from the pattern of the gas mantle, or of the filament in the Nernst lamp, showing in the enlarge-

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ment—a trouble which otherwise is sometimes met with. The condenser glasses should be quite loose and should rattle in their cell, as otherwise when they get hot they may break. Besides the double condenser shown in fig. 12, a triple pattern is made, which gives a distinctly stronger illumination. This is shown in section in fig. 21.

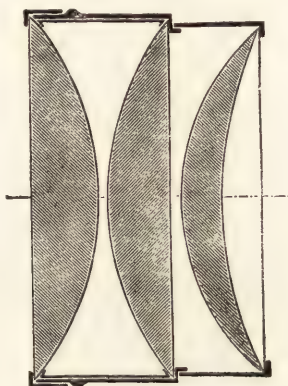


Fig. 21.—A Triple Condenser.

The lantern having been set up and lighted, and a sheet of white paper pinned to the easel, the negative is placed in the enlarger, and all is ready for focussing. The negative, it should be remarked, should always have its film side turned towards the bromide paper, unless the picture is wanted reversed right for left.

A glance at fig. 11 will show the importance of so arranging the relative positions of light, condenser, and lens, that the beam of rays from the condenser is narrowed down sufficiently for all of it to enter the lens. If it does not, either from want of correct adjustment, from the source of light being too large, or from the lens being too

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small, the illumination on the screen will be uneven. Generally speaking, the larger the diameter of the opening in the lens, the easier it is to get even illumination ; but if there is any difficulty from this source, the insertion of a disc of ground glass between the light and the condenser will get over it. This course may not be defensible on theoretical grounds pure and simple ; but in practice it is fully justified by the more even illumination, while the loss of light is not enough to be serious.

It is not usual to adjust the light by noting whether the beam from the condenser falls properly on the lens ; but to be guided entirely by the appearance of the disc of light on the easel. As the position of the lens is governed by the degree of enlargement, the first thing to do is to focus the negative on the white paper on the easel to the desired size.

This focussing need not be done very carefully at this stage ; all that is needed is to get the positions approximately correct. The negative is then taken out of the enlarger, and the light in the lantern is moved to and from the condenser, until the whole area to be occupied by the picture on the easel is seen to be quite evenly illuminated. When this is the case, we know that the light is in the correct position.

The negative is then put back, and the final focussing is done as carefully as possible. For this purpose a pinhole or scratch on the negative is very useful, as it gives a bright spot with well defined edges, which is easily focussed. The focussing should be done with the full aperture, and the lens should then be stopped down to the necessary extent. If it is a modern lens of good quality, the necessary stopping

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down will be very slight ; in fact, the full aperture can generally be used and in all cases it is advisable, when working with a condenser, to use the largest aperture that will give the definition required.

In some apparatus the easel is provided with a patch of ground-glass in the centre, so that one can focus from the back ; but there seems to be no real advantage in this ; and if it is covered with a piece of clean white paper, on which are ruled lines to indicate the size of picture required, and this paper is pinned smoothly down, nothing better for focussing purposes can be required.

The lens should be fitted with a cap of orange glass, and this being put on, the bromide paper is pinned up in position, and the exposure made. Dark-room pins are the most convenient for fastening the paper in position ; the glass-headed pins sold by the Kodak Co. being very suitable.

A point which does not have the attention from some designers of enlarging apparatus which it should have is the light-tight character of the body. Some enlargers are very bad in this respect. No appreciable light should come out of any of the ventilation holes, nor out of the chimney. To test this point a corner of the bromide paper on the easel should have a little piece of black paper pinned across it before the exposure is started. It should be a part which lies beyond the boundary of the picture, so that it receives no light from the lens in the ordinary way during the exposure. If, on development of the enlargement, that part of the bromide paper which was underneath the black paper is perceptibly whiter than the part just outside—if, for instance, the edge of the black paper can be followed on the bromide enlargement—it is clear that there

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is stray light in the room, which is fogging the paper to that extent. This stray light may be due to a dirty lens in the enlarger, or to light escaping from the lantern where none ought to get out, or it may be due to the yellow glass cap of the lens, or to the dark-room lamp itself. But whatever the cause, it should be hunted down and removed ; as, unless this is done, the enlargements will not be as good as they might be.

The exposure in enlarging is very quickly learnt, since the light is, or should be, constant. It is advisable, however, always to use the same stop in the lens, as otherwise the correct exposure cannot be calculated. For the rule with which every photographer is so familiar in his ordinary work, that $f/11$ requires twice as long as $f/8$, $f/16$ twice as long as $f/11$, and so on, no longer holds good, when a condenser is used.

The reason for this is seen at a glance on looking at fig. 11, since the condenser brings the rays down to a point, or at least to a disc, which may be smaller than the stop in use. If that is so, the stop may be opened up to any extent without any more light passing, or closed down without cutting off the light in the usual manner. As a matter of fact, however fine the point of light to which the rays are brought by the condenser, *some* difference in the illumination of the picture on the easel will be noticed as the stop is altered ; but it is not proportional to the stop, and so a knowledge of the number of the stop used, and the exposure, gives us no clue to the exposure required by a stop with some other f number. The only plan is to make a trial. So that it is best to do all the enlarging with the same stop ; and as the negatives are always flat, or should

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be so, and the other conditions affecting definition are the same, it causes no inconvenience to do this, so long as we are always working with the same size of negative.

In order to keep the exposure problem a simple one, the illuminant, whatever it may be, should always be used at its highest power. To do this it is not sufficient to see that the gas is fully turned on, or that the wicks of the lamp are just short of smoking. The mantle should be a fairly new one, and should be hanging evenly, and be evenly incandescent; while with the oil lantern, the oil should be of the best, the wicks bone dry and carefully trimmed, and the chimney properly adjusted. The lime-light is not very suitable for enlarging, as its strength is constantly fluctuating and uncertain.

It has already been shown that the camera lens will do very well for enlarging work. The author uses an old rapid rectilinear of about 6in. focus in his enlarger, and finds it very suitable. It is fitted with Waterhouse stops, and the one marked $f/11$ is that which is used for enlarging. A modern anastigmat working at $f/6$ or $f/7$, and giving critical definition at its full aperture, is an enlarging luxury, not a necessity. But a rapid rectilinear a little longer in focus than would be used in the ordinary way for a plate the size of the negative that is being enlarged will do very well, and the type is now a very cheap one. It is better to have a separate lens on the enlarger, if it can be afforded, if only to prevent such an unfortunate mistake as once happened to the writer, when he found himself in a magnificent country for photography with a *lensless* hand camera, the lens being on the enlarging apparatus at home.

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The negative holder in some modern enlargers is a very elaborate affair, having arrangements for swinging and tilting the negative in various ways. These devices are used either by themselves or in conjunction with the swinging easel, in order to remedy distortion, etc., in the negative. (See Chapter VIII.)

As already pointed out, it is possible to use daylight enlargers with artificial light. For example, behind the negative we may arrange a white reflector at an angle of 45° , and may illuminate this reflector with magnesium ribbon, taking care that the direct light from the ribbon does not strike the plate. Or two or three pieces of ground-glass, an inch or so apart, may be arranged behind the negative, and magnesium burned behind the glass, keeping the ribbon moving all the time. It is difficult to get even illumination with ground-glass at any time, however, and the evening use of daylight enlargers is not very satisfactory, unless the enlarger is fitted with a modern rapid lens. The lens in most fixed focus daylight enlargers is stopped down very much—a thing that is no drawback when daylight is used, but is a decided hindrance when attempting to use artificial light and some kind of diffuser.

Before going on to consider the development and finishing of the enlargement, it will be well to stop for a moment and see what part the character of the negative will play in the quality of the final result.

Needless to say, it must be as sharp all over as it is possible to get it. Enlarging is a magnifying process, and any slight want of sharpness in the negative will be intensified and exaggerated in the enlargement. There must, of necessity, be some falling off in definition, but it need

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be very slight, and ought to be quite unnoticeable in the enlargement. One does not, or at least one ought not, to peer into enlargements; and it is natural to hold them off at such a distance that they can be seen comfortably. At this distance, if the original negative was dead sharp, the enlargement also should look perfectly sharp, even if it is, say, a 15×12 picture from a quarter-plate. This is assuming that the enlarging has been properly carried out.

But, apart from its definition, the character of the negative plays a very large part in deciding the character of the enlargement. If it is too thin and flat to give a good print at all, it will be too thin to give a good enlargement. But there is this peculiarity about enlarging—that it tends to give a pluckier image than contact printing. For instance, if a contact print and an enlargement are made from the same negative on the same make of bromide paper, the enlargement will be distinctly the brighter in contrast. Hence a negative that is in the least inclined to give a hard print is unsuitable for enlarging, unless some means are employed to counteract its hardness, such as Sterry's process (see page 93).

It is well known that gaslight papers give greater contrast than the ordinary bromide papers, so that if the negative is very flat indeed, the best result will be got by enlarging it on gaslight paper—a process which is easy enough in a daylight enlarger, and is not impracticable by artificial light, although the exposure required is a long one.

As every little imperfection in the film of the negative is magnified in the enlargement, the negative should be as clean and free from pinholes as possible. The glass side must be carefully cleaned. It is not practicable to enlarge

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negatives which have been elaborately retouched, or which have been covered with tissue paper on the back, and have been worked on. A little careful spotting will save work on the enlargements ; but beyond that nothing should be attempted on the original negative. Celluloid film negatives should be clipped between two pieces of clean glass to be enlarged.

CHAPTER V.

Bromide Paper.

THE RELIABILITY OF THE STANDARD MAKES.—DIFFERENCES BETWEEN "BROMIDE" AND "GASLIGHT" PAPERS.—THE SENSITIVENESS OF DIFFERENT BRANDS.—GLOSSY, SEMI-GLOSSY, AND MATT PAPERS.—SUITABILITY OF DIFFERENT SURFACES.—WHITE AND TINTED PAPERS.—BROMONA.—ALUMINIUM SURFACE BROMIDE PAPER.—THE STORAGE OF THE PAPER.—THE ILLUMINATION OF THE DARK ROOM.

THE mainstay of the photographic enlarger is bromide paper. Other papers have been employed, and enlargements made by means of direct sunshine—the so-called "solar enlarging camera"—upon a kind of p.o.p. and upon platinum paper; while, as will be seen later on, a good deal of enlarging is still done on dry plates. But bromide paper—paper coated with silver bromide and other silver salts suspended in gelatine—is by far the most widely used. Its manufacture is now conducted by many firms, with extensive plant and most perfect machinery on a very large scale, and has been reduced to a state of perfection which is little short of marvellous. Using the papers of one or other of these big manufacturers, obtained direct or from a dealer who is reliable enough not to attempt to pass off very old and badly-kept stock, there is a probability so great as to amount to a virtual certainty that the paper is quite free from fault. Man being but fallible, it is only reasonable to suppose that at some time or other defective bromide paper has got out on to the market;

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but in an experience of over twenty years, the writer has never once got a packet of paper from any of the leading manufacturers that was in any way imperfect.

Moreover, bromide paper keeps well, almost indefinitely, and, in spite of its sensitiveness to light, may be described as a fairly robust product, not easily injured, so long as it is kept from damp and from noxious fumes.

This point has been put fully in order to discourage anyone taking up enlarging and not getting a result at first as good as he would wish, from jumping at once to the conclusion that it is the paper that is at fault, and not himself; and so failing to discover where the trouble really lies and to remedy it. It is almost certain to be somewhere in the manipulation.

Bromide papers on the market differ in two ways—in sensitiveness and in the character and tone of the paper support. There are two main divisions into which the paper may be classified—one is what is usually called “bromide paper,” and the other is known as “gaslight paper.” The basis in each case is silver bromide; but gaslight paper, besides some difference in the composition of the emulsion, is very much less sensitive; in fact, as its name implies, it is purposely made so insensitive that it can be worked in ordinary gaslight without requiring a dark room at all. This unfits it for most enlarging, although with daylight enlargers, as already pointed out, it can be used satisfactorily.

There are considerable differences in speed between the different makes of the ordinary bromide papers. Thus Watkins in a recent speed list put the sensitiveness of a few of the principal brands as follows:

BROMIDE PAPER.

Barnet	..	..	..	..	8
Griffin	..	..	..	..	25
Ilford (slow)	..	..	..	..	12
Ilford (rapid)	..	..	..	..	30
Kodak (slow)	..	..	..	..	6
Kodak (rapid)	..	..	..	..	25
Paget	..	..	..	..	9
Wellington	..	..	..	..	25

There is not the same need for speed with bromide paper that there is with plates, and sensitiveness need not be taken into account in selecting a paper. It will be found that the different makes differ a little in the gradation which they will give, some tending to give more contrast and some a softer result; and, although there are exceptions, it will be found as a rule that the slower the paper the more contrast will the enlargements upon it possess. But the differences are only slight, and there is no paper of standard make now on the market which will not give first-rate enlargements from negatives which will give good prints on p.o.p.

The papers coated, and the surfaces given to the emulsion, vary very widely. Most makers issue a glossy bromide, the surface of which has a polish, which can be made of extreme brilliance by squeegeeing the paper to glass, ferrotype sheets, or pulp boards, as is done with p.o.p. The glossy papers are useful when the enlargements are being made for reproduction or press purposes, and are also to be employed whenever it is important to show as much detail as possible, as in the case of photomicrographs; but for pictorial work, and generally for enlargements which are going to be framed under glass, it is better to select a paper which is not quite so shiny.

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Next to the glossy come the "semi-glossy"—sometimes called "carbon-surface"—papers, because prints on them have much the same sort of surface as a carbon print. The original bromide paper was always of this description. Then there was a rage for matt, rough and very rough surfaces, which has not yet entirely died down; and the "semi-glossy" paper almost ceased to be made, at least for amateur use. Then came the introduction of sulphur toning methods, and it was found that no paper gave so rich an effect with them as this same semi-glossy, so that now that particular surface is very popular. The amateur photographer for his first enlargements cannot do better than select paper either of this surface or of the next to be mentioned.

Platino-matt bromide paper is quite without gloss or sheen, but is in no sense rough. Starch or some similar substance has been added to the coating, so as to give a surface resembling that of a platinum print. It is a very fine matt, so fine that there is little if any loss of detail in enlarging on it, certainly none whatever that can be detected when the enlargement is framed up. It is, however, free from the sheen of the glossier papers, and takes a pencil or a brush for spotting purposes, or crayon if the enlargement is to be worked up to any extent. It is, and will probably remain, the most popular of all the kinds of bromide paper.

Besides the platino-matt papers, there are papers with several degrees of roughness of surface, known as "rough," "extra rough," "crayon," and so on, as well as by distinctive trade names given to them by the different makers. As a general rule, the larger the picture the rougher may

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be the surface of the paper on which it is made ; but to this rule there must be exceptions. When the detail of the picture is important, the paper chosen will be smoother than it otherwise would be ; while when it is felt that the detail is obtrusive, and a broad effect is required, a rougher kind may be selected.

It is sometimes supposed that a rough surface is "artistic" and a smooth surface "inartistic" ; but this, of course, is quite a mistake. There is no such classification possible ; the paper should be chosen simply to suit the work in hand and the taste of the worker. Some of the very rough surfaces have a perfectly regular "mechanical" grain, which is nearly always objectionable. Enlargements that are not to be framed should generally be made on a fairly smooth paper, as when they are held in the hand they are necessarily near the eyes, and the grain is strongly in evidence.

Most bromide paper is white ; but there is a good deal of cream-tinted paper used. It is particularly suitable for sulphur toning, as the tint harmonises better with the sepia colour of the picture than does a plain white. There is a tendency with sulphur toned prints on white paper for the whites to be harsh and glaring. On the other hand, a plain black print on toned paper is apt to look discoloured.

In addition to these varieties, the Ilford Co. for some years has issued, under the name of "Bromona," bromide paper in which the paper itself has a strong tint. Several tints are supplied, and for certain purposes such papers are very effective. Then, again, it is possible to get canvas and linen coated with bromide emulsion, and another

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variety is obtained by coating aluminium surfaced paper, so that the lights of the prints have a silvery appearance. These kinds all have their uses and their admirers ; but until one has learned to make a good enlargement on plain white paper of the platino-matt or semi-glossy description they are better left alone.

The treatment of all these different kinds of paper is the same throughout. The formulæ for development issued by the different makers differ somewhat ; but so long as any one make is used, the same developer and the same treatment may be given the enlargements, whatever may be the colour and surface selected.

Bromide paper is sold in cut sheets and in rolls, which can be obtained up to a width of forty inches ; for amateur purposes the cut sheets will generally be found the more convenient. It should not be kept in the dark room, as this is usually one of the least ventilated apartments, nor should it be stowed on a shelf near the ceiling, especially in rooms where gas is burned, as the air at the top is most contaminated, nor should it be allowed to get damp. The fumes of some chemicals, particularly of sodium sulphide, ammonium sulphide, or the kindred substances used in sulphur toning, injure it directly. With these exceptions, the place of storage is not important, and a packet which has been opened and wrapped up again, and left lying loose in a drawer for two or three years, will in all probability be found with its contents in good order.

The sensitive surface of bromide paper is not so easily injured with finger marks as is the surface of p.o.p. At the same time it should be handled as little as possible, never with damp fingers. The glossy paper is more easily

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injured than the other kinds, and care should be used in taking it out of the packet, not to let the sharp corner or rough edge of another piece, or of the packing cardboard, scrape along the shiny surface.

The best dark room illumination for bromide paper work is a good yellow. Special yellow "safe lights" are supplied, which will answer the purpose excellently; but every yellow glass or fabric will not do, and if there is any doubt about it, it is safer to use a light red, such as is generally recommended as a dark room light for slow ordinary plates. When enlarging in the dark room, and giving an exposure which runs into several minutes, the paper on the easel should be protected from the direct light of the dark room lamp, as no screen is absolutely safe, and a long continued exposure even to a reasonably safe light would fog the paper. Another source of fog on bromide paper is its exposure to white light coming from the enlarging lantern. Enough of this to do any harm may not get to the paper while it is on the easel; but in fixing it up, or in taking it down to be developed, the paper may be accidentally held near the lantern, where a ray of white light can get to it and fog it.

CHAPTER VI.

Developers for Enlargements.

WHAT IS NEEDED IN A DEVELOPER FOR ENLARGEMENTS.
—AMIDOL.—A STANDARD FORMULA.—PRECAUTIONS
NECESSARY WITH IT.—USING DEVELOPER MORE THAN
ONCE.—THE CAUSE OF POOR COLOUR.—METOL-
HYDROKINONE.—A DRAWBACK OF METOL.—A FOR-
MULA.—DISSOLVING METOL.—SINGLE SOLUTION
DEVELOPERS.—ON FORMULÆ IN GENERAL.

THERE is this difference between the development of a negative and the development of bromide paper, that in the latter case the whites of the paper must be kept absolutely clean, and the colour of the developed image must be an agreeable one. In negative making it is hard to avoid at least a faint veil over the clearest parts, while the colour of the image, provided it has sufficient light-stopping power, and is not so non-actinic as to make it a very slow printer, is unimportant. Apart from this, the development of a negative and of a print or enlargement on bromide paper are the same.

Non-staining developers have to be used, then, for developing bromide paper, and of these there are very many, and the number is being added to continually. At one time ferrous oxalate was used, and very good clean pictures it gave ; but it necessitated an acid bath between developing and fixing, and the acid, too, had to be washed out before the print could be put into the hypo without endangering its permanence. So that ferrous oxalate to-day is obsolete.

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By general agreement, the most convenient developer for bromide paper is amidol. This is a trade name for "di-amido-phenol," and there are now quite a number of makes of this substance on the market, known as "Dolmi," "Dianol," etc. They may all be regarded as amidol in making up developers, and used instead of it in any of the makers' formulæ.

Whatever the name by which it is known, it ought when bought to be a greyish white metallic looking powder. When kept, after the lapse of a good many months it tends to go darker, and may ultimately become quite black. Although amidol will develop even in this condition, it is not satisfactory, and the powder should only be used so long as it is not a very dark grey. Amidol does not keep well in solution, and it is best to make up the developer just as it is required. This is easily done, as it is extremely soluble. No caustic alkali or alkaline carbonate is required with amidol, a plain solution of the substance in a solution of sodium sulphite being an effective developer; but it is usual to add a trace of potassium bromide to the developer in order to ensure perfectly clean whites. The following formula, which is that issued by Messrs. Wellington and Ward, may be taken as typical of an amidol developer for bromide paper, and has been used by the writer successfully with almost every make of paper on the market, and could probably be used equally well with all:

Amidol	..	..	..	..	50 grains
Sodium sulphite (crystals)	..	..	..	..	650 "
Potassium bromide	..	..	..	..	10 "
Water	..	..	..	..	20 ounces

To make up this developer it has been recommended that the sulphite should be kept with the bromide in the

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form of a stock solution, so that all that is necessary is to add the amidol to it, and as soon as it is dissolved to use the developer. This is not at all a satisfactory way of making it up. Sulphite keeps very badly in solution, and when it has deteriorated it no longer works well with amidol, and the enlargements produced with it will be poor in colour and weak.

The only stock solution that can be used with the above is a ten per cent. one of potassium bromide, made by dissolving two hundred and forty grains of the bromide in about four ounces of water, and then diluting it to make five ounces exactly. This keeps indefinitely, and when any potassium bromide is wanted, in making up any formula, instead of weighing out so many grains, all that has to be done is to take ten times as many minims of this solution.

The amidol developer above given is made up, therefore, by weighing out the prescribed quantity of sodium sulphite crystals (which should be clear and waxy looking, and free from any white powder or white coating), crushing them by wrapping them up in a piece of clean paper and rolling them with a jar or bottle, or by hammering. This facilitates solution. The coarse powder so obtained rapidly dissolves in the quantity of water given above, and when it has dissolved and the bromide has been added, the amidol may be put in and stirred up. In about half a minute, it, too, will have dissolved, and the developer is ready for use. Warm water may be used to dissolve the sulphite, if preferred; but, although it effects solution quicker, it does not actually save any time, as the developer must on no account be used until it is back at the ordinary temperature of the other solutions and of the water.

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Instead of the crystals of sodium sulphite, referred to in the above-mentioned formula, anhydrous sodium sulphite may be used. This is a fine white powder, which in a stoppered or well corked bottle keeps as well as the crystals. It is twice the strength of the crystals, so only one-half the weight of anhydrous sulphite is required. It is generally more costly in use, and is not so universally obtainable as the crystals. On the other hand, it is usually purer, and dissolves more quickly.

The developer may be used for more than one enlargement; but it is not safe to lay down any rule as to the number that can be done with one lot of solution, since this depends not only on the area but on the nature of the pictures. It is preferable, indeed, not to use the developer more than once, but to divide it up into as many lots as there are enlargements to develop, and throw each away when the development is done. This is not wasteful, as if only just sufficient to develop a sheet of paper is used for each, it will be too contaminated with the by-products of development to be fit to use for another. The exhaustion of the developer is shown by the enlargements no longer being a good black colour, but of a greenish black tint, and this will be found to appear long before the developer ceases to have any developing power. As the poorness of tint may go unnoticed in the dark room, it is best to ensure against it by taking a fresh lot of developer for each picture.

The poor colour referred to is due to the presence of bromide in the developer. It may be brought about, therefore, by adding too much bromide when mixing up the solution, so that this should be guarded against, and on

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no account should more be used than is given in the formula above. The action of the developer on the emulsion on the paper is, amongst other things, to form bromide, which dissolves in the developing solution, and acts just as if the bromide had been added in excess in the first instance. So that the repeated use of the developer is a mistake.

There is one ingredient in the developer which may be varied within wide limits, and that is the water. Gaslight papers require a stronger developer than ordinary bromide papers, and the formula just given should have about a third of its water omitted and its bromide doubled if it is to be used for such papers, but it is better with gaslight papers to employ precisely the formula issued by the maker. But for bromide paper work the quantity of water stated may be regarded as a minimum, and the developer may be freely diluted up to as much even as three times the quantity of water given.

The effect of using a more dilute developer is first to slow down development. By doubling the quantity of water, the time of development is more than doubled. But besides this it tends to give a flatter result than before, the shadows not being so rich, although the higher tones may be brought out almost as much as with the strong developer. For certain purposes, such a result may be preferred; but it is much better to get it by the use of a soft harmonious negative, which, with the full strength of the developer, will give beautifully soft enlargements. Dilution should never be used when the enlargement is to be sulphide toned, as it leads to poor yellow-brown colours. When a harsh negative is being enlarged, diluting the developer is only one way of dealing with it; there are other and better ways. (See Chapter VIII.)

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The colour of the enlargements obtained with amidol is a very rich black, which may be toned to a fine deep sepia.

Next in popularity to amidol as a developer for bromide paper comes metol-hydrokinone, sometimes called metol-quinol, or m.q. This also gives a fine black, not noticeably different from that obtained with amidol, although a close comparison shows it to be slightly more of a brown black and less of a blue black. It has the advantage that it may be made up into a single solution developer, which will keep for a considerable time if it is put into a number of bottles, each of which is quite full, and is well corked. It may be mentioned here that all developers deteriorate the more quickly the more they are exposed to the air; so that while a solution may be in good order many months after it is made up, if it is in a full, well corked bottle, some of the same solution put into a big bottle, which is often opened for some to be taken out, and corked up again, may have become quite useless.

The chief drawback of the metol-hydrokinone developer is that metol affects the skin of some people very injuriously. Its action is most erratic. The writer used it for years for developing negatives as well as prints and enlargements. Then came a time when the fingers started to itch, and became covered with a multitude of little white spots. The irritation was excessive, especially between the fingers, and after some little time the skin peeled off. Of course, metol was most carefully shunned while the hands were in this state, and the unpleasant symptoms gradually subsided and eventually disappeared. Frequent washing in warm water, followed by a good rubbing with lanoline,

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helped the cure. This is the usual course of events with those who suffer from metol poisoning, and the proportion of people who are susceptible to it seems to be quite a large one. It does not appear to leave any permanent injury behind it, but it is very unpleasant while it lasts, and it has the curious result that, while one may go on using metol for years without any trouble, when once it has affected the skin in the way described, it leaves it extraordinarily susceptible to a repetition of the complaint. The slightest trace of metol getting to the skin is enough to bring it all on again with anyone who has had it once. But many people use metol and suffer no inconvenience from it at all, and for such it is an excellent developer.

The formulæ for its use for bromide paper differ very widely in the relative proportions of metol and hydrokinone. One of the best is that given in the Kodak instructions. It is as follows:

Metol	..	..	..	..	8 grains
Hydrokinone	..	..	..	30	„
Sodium sulphite (crystals)	..	..	..	360	„
Sodium carbonate (crystals)	..	..	..	360	„
Potassium bromide	..	..	..	2	„
Water	..	..	..	..	10 ounces

For use with bromide paper, equal parts of this stock solution and of water are taken. For gaslight papers the undiluted stock solution answers very well.

In making up the above formula, the metol should first be dissolved in the water, and then when this is complete the hydrokinone should be added, each ingredient being dissolved before the next is put in. If this is not done, it will sometimes happen that the metol, or a great deal

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of it, will go out of solution, and no heating or stirring of the liquid seems to have much effect in redissolving it. The anhydrous sodium sulphite, as mentioned in connection with amidol, may be used if preferred, and anhydrous sodium carbonate, another fine white powder, may be substituted for the crystals mentioned in the formula, in the proportion of 130 grains of the anhydrous instead of 360 grains of the crystals.

The remarks that have already been made with reference to dilution of the developer, and to using it over and over again, and to the presence of bromide in it, apply equally to metol-hydrokinone.

There are many other developers for enlargements, but the two already named are those most widely used. The concentrated single solution developers, which are put on the market under a variety of trade names, such as Rodinal, Azol, Certinal, will all be found very suitable, only needing dilution. But none of these give quite as deep rich blacks as the amidol, though for delicate pearly greys they are equal to any.

Whatever the formula selected, the photographer should stick to it until he has thoroughly mastered its use. The author writes from long experience, as far as the formulæ given in this chapter are concerned; and if the enlargements obtained with them are not as satisfactory as they should be, one is quite safe in assuming that some mistake has been made in mixing up the developer, or in using it, and that the formula itself is not at fault. Some photographers seem to spend the whole of their photographic career in wandering from formula to formula, in the hope of ultimately dropping on one which will give a good enlargement

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every time, and yet they never get what they seek. This is dropping the substance to grasp the shadow. The substance is experience and knowledge. If the negative is a good one, the bromide paper one of the standard brands, and the exposure correct, any of the developers mentioned in this chapter will develop an enlargement perfectly, and there is nothing to choose between them. If any of those conditions is ignored, then there is no developer which will give a perfect enlargement, and there is no choice between those already named. All are equally incapable of doing anything to remedy the imperfections that result from a poor negative, bad paper, or wrong exposure.

The more a photographer's experience extends, the less he comes to regard formulæ as important ; and with this observation we may well bring to a close a chapter which has dealt with them.

CHAPTER VII.

Developing.

THE DILUTION OF THE DEVELOPER.—LARGE DISHES.—
A PRELIMINARY WETTING.—HOW FAR TO CARRY
DEVELOPMENT.—DEVELOPING WITHOUT DISHES.—
THE PREVENTION OF STAINS.—THE FIXING BATH.—
ACID FIXERS.—ENSURING COMPLETE FIXATION.—
WASHING ENLARGEMENTS.—HYPO ELIMINATORS.—
DRYING.—SQUEEGEEING FOR A GLOSSY SURFACE.

THE image on a sheet of bromide paper, like the image on a dry plate, is not visible until it has been developed ; and we have already seen that development in the one case is very similar to development in the other. There is this difference at least, that while opinion is divided on the point whether it is or is not possible to control the quality of the negative by modifying the developer, all are agreed that nothing of this sort is of any use in developing a piece of bromide paper. The developer may be diluted, it is true, for certain purposes ; but, apart from this alteration, and its effect is at no time great unless the dilution is carried so far as to be injurious, there is nothing gained by any modification of the developer, nor by variations in the way it is applied. The image is there, and the developer is used to bring it out, and to bring it all out ; and when that is done, a little longer time in the developer makes very little difference.

Enlargements are usually, but not invariably, developed in dishes. For sizes up to 12 × 10 porcelain or vulcanite dishes of the ordinary kind are very suitable. The former

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show any dirt at once, the latter are light, flat, and take up less room. For large sizes, dishes of wood, either provided with a glass bottom or with a wooden one, are often used. The writer uses papier maché dishes for large sizes. They are cheap and light, but are supposed not to wear very well. If the precaution of draining and drying them after use is taken, and they are kept in a dry place, they will wear for years, and are practically unbreakable. Metal dishes are not very suitable, but with two or three coatings of Brunswick black they can be made to serve.

Very large dishes are costly, but a cheap kind may be made by first constructing a dish of wood, well varnishing it, and then giving the interior a coating of paraffin wax. Oil-cloth is then laid all over the inside, its edges being brought over and tacked down outside. By pressing it down into position with a warm iron, the wax is melted, and the oil-cloth adheres to the wood. When necessary, it can easily be pulled off and a fresh piece laid down.

It is usual to wet the paper with plain water before pouring on the developer. This makes the enlargement limp, so that it lies flat on the bottom of the dish, and is easily covered quickly and evenly with the developer. There is no other advantage in the wetting, and it may be omitted, if preferred. The paper should be laid in the dish, and water run on to the face of it. After the lapse of a few seconds it should be turned over and left until quite limp, after which it is turned over again, the water poured off, and the dish drained for a moment, with the enlargement adhering to its bottom, so as not to dilute the developer more than one can help, and then the developer is poured on. A preliminary wetting, in the case of plates,

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is a fertile cause of air bells, but these seem to give no trouble at all in the case of bromide paper.

The developer should be poured over the face of the enlargement with a sweep, so as to wet it all over at practically the same moment, and, for the first few seconds at least, the dish should be well rocked so as to make sure that the edges as well as the centre of the enlargement get their share of the solution. It may then be lifted up and laid face downwards in the dish, and the rocking continued, so as to wet the whole of the back of the paper. If any air bells are seen on it, they may be broken by being touched with the finger. The enlargement is again turned over, and by this time, unless the developer is a very slow-acting one, the image will be showing well.

In the development of a plate, it is always a problem how far that development should be carried; but no such question arises in the case of enlargements, because if the exposure has been correct, and the developer is properly mixed up, when the action is complete there seems to be a kind of pause. The development does not actually stop altogether, and if the enlargement were left in the solution for a good deal too long, it would get heavy and dull, and the high lights would be stained; but it slows down in a very marked manner, so that if the time it has already been in the developer is, say, three minutes, it will not make much difference, whether it is taken out at the end of that time or left in for another minute or a minute and a half. Of course, if the dark room light is unsafe, or if the developer itself is so strong as to fog the paper, it cannot be left in like that; but with the developers given in the previous chapter this will be found to hold good.

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This phenomenon is a very convenient one from the point of view of the photographer, as it removes any risk of making an error in the timing of the development.

It is best to make quite sure that the stage just referred to has been reached, before regarding the development as complete. This is particularly necessary if the enlargements are to be sulphide toned, as, unless the development has been full, this process gives a pale washed-out result of a yellow-brown colour. But even if the prints are not to be toned, it is best always to give them as full a development as possible. The practice of snatching the enlargement out of the developer the moment the action seems to have gone far enough may result, in the case of an over-exposed enlargement, in giving not quite so bad a picture as would be obtained if the development had been carried on in the way described. But if the exposure has been correct, it will give a feeble weak print ; while if the exposure has been too long, it is much better to realise the fact, and make another.

There is no means of turning an incorrectly exposed enlargement into a good one. The best thing that can be done with it is to use it as a guide to the correct exposure, and then to tear it up.

It has been pointed out above that enlargements can be developed without a dish. To do this the enlargement is laid upon a sheet of glass or a board, and is well wetted back and front with water. A clean piece of sponge is then soaked in the developer, and the print being held horizontally, the sponge is quickly passed all over the face of it. The developer is replenished from time to time, the sponge being kept moving until development is complete.

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After a good rinse under the tap, the fixing may be done in exactly the same way, taking care to give it an extra five minutes to allow for any possible uneven action ; and then after another rinse the enlargement may be washed. To do this it may be attached to the glass or board, so that it will not slide off, and be left under the tap, with a gentle stream of water flowing over the face of it for half an hour. It is then turned over and the back is washed in the same way, after which it is turned once more for five minutes, and may then be pinned up to dry. Or it may be washed in the household bath. Or the orifice of the sink may be stopped up, and a dish for washing an extra big enlargement constructed in that way.

When a piece of bromide paper has been developed, the pores of the paper, as well as the coating of the emulsion, are full of developer, which, as a photographer soon learns, is a liquid which on exposure to the air rapidly becomes brown and opaque. If the developer is left in the paper, it turns brown just as quickly, and stains the paper. Hence it should be washed out as quickly as possible. Now, if the enlargement is transferred direct from the developer to the fixing bath, and when there is kept moving, or the fixing solution is kept moving over it, say, by rocking the dish, that solution will not only fix the print, but will do a good deal towards washing out the developer, and so tend to prevent staining. But it is simpler and better to make it an invariable rule to wash the enlargements in several changes of water between developing and fixing, turning them over so as to wash both back and front, and get rid of as much as possible of the developer. With developers which contain hydrokinone, this is important if a bad yellow stain is to be avoided.

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There are two kinds of fixing baths used for bromide paper—plain hypo and acid fixers. Each has its advocates ; and, as might be imagined from that, there is little or nothing to choose between them. It is customary to recommend a plain solution of hypo for fixing when amidol has been the developer employed, because acid fixing baths usually contain sodium sulphite, and sodium sulphite acts as an accelerator with amidol. There is, therefore, just a chance that the sulphite might act on any amidol left in the pores of the film, and so produce fog. But if the enlargement is washed, as directed, between development and fixing, there should be little likelihood of anything of this kind occurring.

A plain fixing bath is made by dissolving the requisite quantity of sodium hyposulphite in water. As hypo solution keeps indefinitely, it is a good plan to have a stock solution that can be drawn upon for fixing purposes generally. A convenient method of making such a solution is to get one of those blue glass narrow mouth bottles known as "Winchesters." One of these holds eighty ounces, and so if a pound of hypo is put into it, and the bottle is filled with water, when the hypo is dissolved we shall have a twenty per cent. solution (four ounces to the pint). This is the strongest that will ever be wanted, and may be used as it is for fixing negatives. For bromide paper work a convenient strength is two ounces to the pint, obtained by taking equal parts of this stock solution and water.

It should be noted that hypo, as it dissolves, lowers the temperature of the liquid a great deal. As it is important that all the solutions into which the bromide paper is put are of the same temperature, and as fixing proceeds

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very slowly in a cold solution, either the hypo should be dissolved in hot water, and the solution then be cooled to the temperature of the others, or, what is better, it should be made up a day or two before it is wanted.

An acid fixing bath is one which contains free sulphurous acid. This substance, which may be regarded as the active principle in sodium sulphite and in metabisulphite, is a powerful preventive of stains. That is why one of the last-named salts figures in most developing formulæ, and that is why acid fixing baths are by many preferred to plain solutions of hypo. There is, in any case, no valid objection to the use of an acid fixing bath.

The simplest way of making an acid fixer is to take a solution of hypo and add to it some sulphurous acid. Sulphurous acid, in dilute form, can be obtained from any chemist, and if to each pint of fixing bath half an ounce of this acid is added, a satisfactory acid fixing bath is ready at once.

For some reason or other the use of sulphurous acid itself for the purpose is not very great; it is generally added in an indirect way. For instance, potassium metabisulphite is a salt which contains sulphurous acid with which it readily parts, as its smell is sufficient to show. A quarter of an ounce of potassium metabisulphite added to each pint of the fixing bath is a most efficient acid fixer.

Sodium sulphite by itself is not of any service for this purpose, as the sulphurous acid is not in a free condition. But by adding some other acid to a solution of sodium sulphite, sulphurous acid is at once liberated, the smell again being excellent evidence of the fact. Thus half an ounce of sodium sulphite may be dissolved in two

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ounces of water, and a dram of citric or of tartaric acid in another two ounces. These solutions are then mixed, and two ounces of the mixture added to each pint of the fixing bath. For reasons into which there is no need to go here, this is the least satisfactory way of making up an acid fixer.

There is a liquid which is readily obtainable in France known as "acid bisulphite lye" or "bisulphite lye." It is sold in England by several firms, such as Messrs. Johnson and Sons, of Cross Street, Finsbury, and forms a cheap and convenient way of making up an acid fixer. Half an ounce of the lye is added to each pint of the fixing bath.

All these formulæ for acid fixing baths are merely approximations. As long as there is enough of the sulphurous acid, or its equivalent, to prevent staining, the actual quantity is quite unimportant, so that whether half an ounce or two ounces of metabisulphite or of lye is added to each pint of the fixing solution makes no difference, except that some at least of the extra quantity is wasted.

Whether the fixing bath is acid or not, it must be applied for a sufficient time to ensure the complete fixation of the enlargement. There is no very direct means of ascertaining when an enlargement is properly fixed without spoiling it, so that an indirect means is employed, by taking care that the fixing bath shall be of such a strength and applied for such a time as to make quite sure that its action is complete. The maker's instructions generally give both the strength recommended and the time the print should be left in it; and nothing less, on any account, should be given. It must not be supposed that by increasing the strength of the hypo bath that fixing is proportionately quickened; beyond a certain point it is not quickened

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at all, and a solution of four ounces of hypo to the pint wants almost if not quite as long as one of two ounces. The latter is a convenient strength to use for bromide enlargements, and at ordinary temperatures any bromide paper on the market is completely fixed in such a solution in a quarter of an hour.

It does not do, however, merely to put the enlargement in the hypo and leave it for that time. If left, it is sure to float up to the top of the liquid, parts of the enlargement will be above it, and only just moist. In such a condition, not only is there every chance that a stain will be formed from oxidation of some of the developer still remaining in its film, but there may be a reducing action set up, which will cause some of the more delicate tones in those parts to be eaten away. To prevent this the enlargement should be put into the hypo face downwards, and the dish rocked from time to time, until the fixing is complete. When the enlargement is first put into the hypo, if it is watched closely, a kind of film or veil will appear to pass off its face, and the shadows will at once gain in depth, and the picture will look brighter and better than it did in the developer.

It is not wise to expose the enlargement to any light but that of the dark-room lamp until it has, at any rate, been in the hypo solution for at least a minute or two. In fact, it is better to leave it until it is quite fixed before looking at it in white light.

After fixing comes the washing. The hypo has done its work, it has dissolved out all the unaltered silver bromide, and now, if the enlargement is to be as permanent as it can be made, all trace of the hypo must be washed

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out of it. For this purpose the ordinary print washers are not usually of much assistance, as they are made to take smaller prints.

The best way to wash an enlargement is in a dish. It is a little more trouble than merely leaving it, with the water running on it out of a tap, but it is a great deal more effective, quicker, and uses less water. The enlargement is taken from the fixing bath, laid face upwards in the dish, which is then filled with water. The print is turned over, so that its back as well as its face is rinsed, and after half a minute is taken out and allowed to drain until it almost ceases to drip. The dish is then emptied, well rinsed, filled with clean water, and the enlargement is put back. After a minute or so it is turned over, and after another minute is again drained, the dish not merely emptied but rinsed out, and then refilled. Ten complete changes of this kind take a little over half an hour. To give them is a little tedious; but at the end of that time the enlargement may be pinned up to drain and dry with the comfortable assurance that it has been properly washed, and is as free from any trace of hypo as anyone could wish.

Mere soaking in water, unless there is a very great deal of water to dilute the hypo solution as it diffuses out, is not of much use.

If the enlargement is left lying in a dish undisturbed for some time, steps should be taken, especially during the earlier stages of washing, to prevent it from floating up, so that parts of it are exposed to the air. An easy way of doing this is to leave it in the water face downwards, and to float on top of it an ebonite dish, which may

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be weighted down if necessary by running a little water into it. But if left for half an hour or more like this, it will want just as many and as thorough changes to wash it properly as it would do were the soaking omitted.

One way of washing a single enlargement is to take a large cloth, set the dish in the middle of it, and gather up the cloth all round. The dish is supported on something just under the tap, the ends of the cloth are tied round the tap, and the water is set running. Three-quarters of an hour of this treatment will usually wash the enlargement properly.

Another method is to give the enlargement as many complete changes and drainings as there is an opportunity, and then to fill the domestic bath with water, and pinning the enlargement face outwards on a board, to float it, with the enlargement downwards, of course, on the surface of the water in the bath. This is not quite the same as soaking it in a comparatively little water in a dish; and three or four changes, followed by floating like this for an hour, followed in its turn by two or three more changes in the dish, will wash it properly.

The bath may also be used for washing comparatively small enlargements vertically. The two top corners of the enlargement are fastened to small corks, either with dark room pins or by means of slits in the corks, and in this way the enlargements will float upright, with the top edge just below the surface. If necessary, a couple of dark room pins may be pushed through the two bottom corners to act as a kind of ballast. The advantage of this method is that it allows quite a number to be washed at once. There should be two or three inches of water below the

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bottom of the enlargements, and the water should be changed twice or three times.

Thus the washing of an enlargement is very much like the washing of a print, except that enlargements are less numerous, bigger, and often are on a comparatively thick spongy quality of paper capable of holding a great deal of hypo in its pores.

There are various substances which decompose the hypo, and so act as "hypo-eliminators." One of the best of these is a fluid, sold by Messrs. Marion and Co. under the title of "Hypono." Some careful tests of this made by the author two or three years ago showed that it got rid of the hypo very effectively and quickly. The best way to use it is to give the enlargement as much washing in water as is possible, draining it well between each change, and then to leave it for five minutes in a bath of "Hypono" one dram, water half a pint. It is then given two or three more changes of plain water, and is hung up to dry. A very weak solution of potassium permanganate has also been suggested for the same purpose. It should be just pink in colour, and it has the advantage that it not only decomposes the hypo, but it also shows unmistakably when the hypo is all destroyed. The enlargement after treatment is placed in a solution of potassium permanganate with only the faintest perceptible trace of the pink colour, and is left in it for a minute or two. If after the lapse of that time the pink colour still remains, it shows that there is no trace of hypo in the film. The test can be applied another way. A glass with the just tinted water is stood upon a sheet of white paper, and the drainings from the enlargement are allowed to drop into it. If the pink colour

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remains unaltered, except for such dilution as might be expected, the hypo is washed out ; but if there is still any in the paper, and in the drainings from it, the pink colour will be changed to a brownish yellow, which, being nothing like so intense, will probably be unnoticed, the liquid appearing white.

Hypo eliminators have their uses, but when there is a good supply of water it would certainly seem to be preferable to rely upon a thorough washing to get rid of the hypo.

After washing, the enlargements have to be dried. With some waters, a kind of scum collects on the face of the enlargement, just as it does on negatives, and so, while in the last washing water, this should be removed by gently rubbing the face of the print with cotton-wool. As the coating on the paper is gelatine, the enlargement would stick to anything if it were allowed to dry in contact with it ; so it is best to pin it up by two corners to drain and dry. If it is a large one on thick paper, it would tear if any attempt were made to hang it up by one corner only ; but if it is not too heavy, this may be done, and the draining and drying will be all the quicker. The face and the back may both be dabbed surface dry with a clean fluffless cloth to hasten the drying, without injury.

Heat must not be used to dry enlargements, or the gelatine will melt and run. If they are wanted quickly a good plan, after dabbing them as just mentioned, is to open a window at the bottom just enough to let the enlargements when pinned to the bottom edge hang clear of the window-sill. The current of air will then dry them very quickly.

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Although with most enlargements anything like a glossy surface is not required; when they are comparatively small, or are required as originals for process work, or when the finest detail is to be shown, they may be squeegeed. The "glossy" paper is required for this, and in no case should a hardening bath of some kind be omitted. The best plan is to take the enlargements from the last washing water and place them for five minutes in a mixture of one part of formaline with five parts of water. They are then rinsed in a couple of changes of water and dried. When quite dry they are re-soaked in water for a minute or two, and may then be squeegeed down upon ferrotype sheets, pulp boards, or the regular glazing sheets sold for the purpose. If any of these are used and the procedure above described has been followed carefully, there will be no need to treat the ferrotype or other surface with any preparation. If it is clean, and the prints are allowed to get quite dry on it, a little bend, or the raising of one corner with the point of a knife, will fetch them off with a perfect gloss, and without the slightest danger of sticking. If glass is used, it should be dusted over with a little French chalk, and then be well polished.

CHAPTER VIII.

Modifying the Result.

CONTROL.—REMEDYING LEANING LINES.—THE CURE OF DISTORTION THAT HAS BEEN CAUSED BY TILTING THE CAMERA (AND BY A NON-RECTILINEAR LENS).—VIGNETTING.—SHADING DURING EXPOSURE.—BRINGING OUT DETAIL IN DENSE PARTS.—SOFTENING DEFINITION.—THE USE OF BOLTING SILK.—CONTROLLING THE SOFTENING.—GROUND-GLASS.—SOFT ENLARGEMENTS FROM HARSH NEGATIVES.—STERRY'S PROCESS. — COMBINING NEGATIVES. — PUTTING IN CLOUDS.—DEVELOPING AND RE-EXPOSING.

SO far we have been concerned merely with the making of a straightforward enlargement from the negative, without any attempt in any way to alter the character of the result, either to remedy defects that the negative may have possessed, or to introduce what is called "control." Into the "legitimacy" of "control" there is no need to go; whether it is policy to try to exercise it, depends on the ability of the worker. "Control" in many hands may be compared to that which is exercised by the engine driver when he has got his locomotive off the metals. It no longer goes whither those hard and fast guides would have led it; but because its destination is no longer fixed, it does not follow that its driver has more control over it. As a matter of fact he has less. And just as it is less manageable, and is apt to make a mess of things, so the photographer, with some processes, finds all that he has done is to throw his photography off the rails, with similar consequences. But as far as remedying faults in the negative

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is concerned, a good deal can be done without invoking such questionable aid.

A very simple defect is when the camera, instead of being level, has been tilted round sideways, so that upright lines in the picture, which should be parallel with the edges of the plate, are not so. This is remedied by tilting the negative in the enlarger, or the paper on the easel. If neither can be done, it only means that the edges of the enlargement must be cut parallel with the vertical and horizontal lines in the picture respectively. Many of the modern patterns of enlarger are provided with an arrangement by which the negative can be turned; some even have a rack and pinion for doing so, enabling the lines to be brought parallel with the ruled lines on the easel to the greatest nicety. This is easier than pinning up the bromide paper askew, because in the feeble yellow image, which is all that the tinted glass cap on the lens will allow to reach the screen, it is not very easy to see when the lines are quite as they should be or not.

A more serious defect in the negative, which can be completely remedied in enlarging, is due to the camera being tipped up or down, usually up, at the moment of exposure. Every hand camera worker, and a good many of those who use a stand camera, have negatives of buildings or other objects with vertical lines, in which those lines, instead of being parallel, as they should be, converge towards each other. If the camera is tipped up when a building is being photographed, in order to get it all on the plate, everyone knows that the upright lines of the building will in the photograph run together towards the top, making it look as though the building were falling

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inwards. To prevent this, when the camera is fitted with a swing back, the back is swung until, however much the camera is tilted, the plate itself is vertical. But when this has not been done, and the negative has the distortion we have named, it is quite easy to remedy it in enlarging. To do this, either the negative or the bromide paper or both must be swung.

The best patterns of enlarging apparatus are fitted with an arrangement for swinging the negative. Some enlarging easels can also be swung, for the same purpose. These adjustments are very convenient, but they are in the nature of luxuries rather than necessities; and when neither is to be had, the same result can be obtained with an enlarging lantern, either by tipping it up, keeping the paper vertical, or by putting the negative into the carrier sideways, and slewing the easel round.

The exact extent to which the negative and paper should be tilted towards each other must be found by trial. The easiest way to do this is to mark out on the negative, just beyond the boundaries of the picture itself, two lines, not parallel to each other, but parallel to the outermost of the converging lines which are to be corrected. With a sharp knife two cuts are made right through the film in those places. When the negative is put in the enlarger, the cuts, being clear glass, can be very clearly seen, and a very small stop being put into the lens, either the negative or the easel is swung or tilted until the bright lines of the cuts are strictly parallel. This should be found by measurement on the screen. It will be noticed that the further the easel is from the lens the wider apart will be the lines, so that they can be adjusted with the greatest

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accuracy by bringing the one end or other of the easel nearer to or further from the lens as required.

In ordinary photography, when near and distant objects have to be sharply focussed at the same time, a small stop has to be used. So in enlarging, when one end of the easel is much nearer to the lens than the other, we have practically the same state of things, and the lens must be stopped down ; in fact, if the correction to be made is at all considerable, an extremely small stop must be used, or the whole of the enlargement will not be sharp.

When both the negative and the easel can be swung, it is better to swing them both away from each other. This not only allows a larger stop to be used than would otherwise be the case, but it has been claimed that it gives a truer rendering of the original subject. This, however, is rather an open question, and one into which we need not go. For all practical purposes, except as far as the size of the stop is concerned, it is unimportant whether we swing the negative or the easel or both to correct this form of distortion.

There is another form of distortion which is occasionally met with in negatives which can be remedied in enlarging ; though, as it is not very likely that many will have occasion to attempt it, it must only be mentioned in passing. When photographing subjects in which there are straight lines near the margins of the plate, if a single lens is used, as every photographer knows, those lines will be rendered more or less curved. They may curve either inwards or outwards, according to the position of the stop, before or behind the lens. If, in enlarging, the stop is in the same position with regard to the negative

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to be enlarged that it occupied when the original negative was made. it will tend to straighten those lines again, and, by properly adjusting the separation of the lens and the stop, they can be made perfectly straight.

In this way it is possible to remedy defects in the negative in making enlargements which could not be done when making contact prints. But there is a great deal more that can be done by shading the bromide paper and similar devices.

One of the simplest of these operations is vignetting. With fixed focus daylight enlargers, and apparatus of that type, vignetting and shading (although not quite impossible) are still very limited in extent. But when the enlarging is done in the dark room, either with daylight or with an enlarging lantern, so that the photographer can stand beside the easel on which is the picture and see what he is doing, a great deal more is possible. For vignetting, a card is taken a good deal larger than the negative, but not necessarily as large as the enlargement, and an opening is cut in it, the shape of the proposed vignette. This may be held in the hand between the lens and the easel, and moved to and fro a little during the exposure. The movement and its distance from the paper combine to soften the edges of the opening and to give the requisite vignetting effect. A card a little larger than the negative *might* be used above the negative when enlarging with a daylight enlarger, moving the card all the time, in order to get a similar result, but it is by no means so easy.

There are many photographers who do not care for vignettes, but who value highly the power of holding back the printing of one part while allowing the rest to go on.

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This can be done by shading with a card in exactly the same way as vignetting, keeping the card moving to avoid a sharp boundary to the shading. Many negatives which otherwise are quite suitable for enlarging have got, somewhere or other, a patch of extreme density, which in the enlargement comes out a blank white. By taking a card with a hole in it to correspond to this patch, and letting the light act through this hole for some time longer than it does on the rest of the image, such hard parts can be remedied very effectively. If there are two or more such patches, each one may be treated separately, giving first one its supplementary exposure, then another, then another, and so on, finally removing the card altogether, and giving one exposure for the rest of the picture. Those who do this for the first time will be surprised to find how much extra exposure such parts will stand, and even require, without any signs of the treatment being visible in the finished enlargement. It is no uncommon thing to find that some part may require two or three times as long an *extra* exposure as is given to the whole of the negative in the ordinary way.

This treatment is very effective in bringing out clouds which may be in the original negative, but are too dense to show in the enlargement without some such help. The card may be cut to the shape of the sky line, and kept moving over the landscape portion of the picture while the clouds print out. In some cases it is best not to raise the card so that it starts the vignetting in the sky itself, as this may give a light line between the clouds and the landscape, which is very undesirable. When the sky line is more or less straight, the shading may be done with a

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straight piece of card, and in this case may be carried up well into the part which is occupied by the sky. In nature the sky is lightest in the distance along the horizon, so that the effect of shading is in such a case a natural one.

Another effect which is often wanted, and can be obtained in this way very well, is the darkening of the margins of a picture. Light objects near the margin are often very undesirable. In portraiture, for example, it is best to keep the edges of the picture dark, so as to concentrate the attention more towards the centre. To do this, a piece of card may be cut out and fastened on to the end of a wire, or in the middle of a sheet of glass, so that it can be held so as to shield the centre of the picture, while giving an additional exposure to its margins. Other applications of the same method are sure to suggest themselves to the photographer, as the need for them in his work arises.

Shading is only one of the devices that may be adopted in order to modify the character of the result. There are a whole series for altering the definition. It is impossible in enlarging to get better definition than there is in the original negative ; in fact, there must of necessity be some falling off, although it may not be very great, not even enough to be perceptible. But at times the very fine definition is not desirable. It may not be that the photographer is an adherent of the fuzzy school, but he may feel that the utmost sharpness which his negative will give in the enlargement is a little too hard and cutting to be pleasant. There are various ways of remedying this ; but one of the best, and certainly the most popular, is by means of "bolting cloth."

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"Bolting cloth" or "bolting silk" is a very fine fabric of very even grain, which is manufactured for "bolting" or sifting flour. It is sold, by the yard or in cut pieces, by most of the big photographic houses, though comparatively few of the smaller dealers stock it. It is a fairly expensive fabric, so that a piece when bought should be taken care of, by being bound up as described later.

To use this bolting silk it is placed near the bromide paper, the exposure being made through it. The distance which separates the silk from the paper is important. If the silk is laid right down on the paper, and is pressed into good contact with it by covering the whole with a sheet of glass, and the exposure is made through the silk, it will be found on developing the enlargement that the silk has not appreciably affected the definition. All it has done is to give the picture a very fine grain, something like that of a process block, but it is not so noticeable. In the lighter parts this has little or no effect; but in the darker parts, the fact that the image is not continuous, but is cut up by the lines where the threads of the bolting silk have prevented the light from reaching the paper, has the effect of making them less black and solid. So that the result of using the silk in this position is slightly to soften the contrasts of the enlargement without materially affecting its definition.

As soon as the silk is separated from the surface of the bromide paper, however, a difference is noticed. It still lessens the contrasts somewhat, but it also softens the definition; at first only slightly, but as the distance between the paper and the silk is increased, it has a greater and greater effect, until at last the image can be made most

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unpleasantly fuzzy. But if it is not carried so far as that, the effects obtained are very pleasant ; and the improvement, both in definition and in contrast, especially when the negative is a little on the harsh side, may be very great.

The best way to keep bolting silk is to get a sheet of glass a little smaller than the piece in use, and stretch the silk over the glass, binding it at the edges by pasting on strips of paper. When it is to be used in contact with the paper, all that has then to be done is to put this glass down on the easel, with the silk next to the bromide paper. The paper must be fastened with drawing-pins pushed well in, and not with the ordinary dark room pins, as these will not allow the silk to come into contact with the paper. Good contact all over is important, as wherever the paper is not touching the silk, the picture will appear fuzzy.

When the silk and bromide paper are not to be in contact, a convenient separation for most purposes is that provided by a sheet of glass of ordinary thickness, and so, when the diffusing action of the bolting silk is required, the glass bearing it is put on the easel glass side next the bromide paper.

A second sheet of glass may also be interposed, if the first does not soften the definition enough ; but more than two are not likely to be required. If a very great separation is wanted, four glass-headed dark room pins may be stuck into the easel, and the glass carrying the silk pressed against the top of their heads.

The greater the diffusion, the more also will the contrasts of the negative be softened by means of the bolting silk. It requires a small increase in exposure ; it will be found correct when the silk is interposed to give about one-third as long again as is correct without it.

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There are other methods by which a softening of the contrast as well as of the definition can be brought about. A very simple one is to give one-half or more of the exposure in the usual way, and then to hold a card in front of the lens and to breathe on the front surface of the glass ; then, taking the card away, the exposure is continued while the moisture from the breath is still on the lens. This scatters the light into the shadows, and will enable a beautifully soft result to be obtained from quite a harsh negative. But a great deal depends on the adjustment of the two portions of the exposure, so that it should only be attempted when the photographer feels that he is fairly expert.

It is not possible to soften definition advantageously by throwing the enlargement out of focus ; it is best in every case to get as sharp an image as the lens will give, softening this either by one of the methods that have just been described, or by placing a sheet of ground glass or of matt celluloid, or even of tracing paper, on the face of the bromide paper.

The fact that a negative gives a more vigorous print by enlarging than by contact, means that a negative which is at all inclined to be too strong for contact printing cannot be used at all for enlarging in the ordinary way. It is for this reason that so many enlargements fail. High lights which show detail in a small print enlarge as mere blanks without any trace of an image, and the result is a failure. To some extent this can be remedied by the selection of as rapid a paper as possible, but such a remedy is not very practical.

Another plan, which has worked well in the author's hands, is to bleach the negative in one of the many solutions

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that are used for the purpose, as, for example :

Potassium bichromate	90 grains
Strong sulphuric acid	..	..	3 drams
Common salt .. ..	..	..	1 ounce
Water .. ..	..	..	10 ounces

When the bleaching is complete, the negative is washed until all trace of yellowness due to the bichromate has vanished, and is then dried in the dark. The enlargement is made from the bleached negative, which will be a good deal less vigorous than it was before bleaching, although by no means so thin in reality as it appears to be. Exposure to light slowly darkens it, hence the reason for drying it in the dark. When all the enlarging is done, the negative may be brought back to its original condition by being blackened by any non-staining developer, such as the amidol solution given on page 61, washed and dried.

A method which can be carried out without any wetting of the original negative is one which is due to Mr. Sterry. By this it is possible to get soft, harmonious enlargements from negatives of very great density, and the degree of softening is under control. The method is quite simple.

The first thing to be done is to determine, preferably by actual trial, the exposure necessary to give detail in the densest parts of the negative, ignoring the more transparent parts altogether. The sheet of bromide paper is then exposed for that time, whatever it may be. If it were to be developed in the ordinary way after such an exposure, while the highest lights would have the detail which is wanted, the shadows would be altogether too black, and would all have "closed up" to the same dark tone. To prevent this, the enlargement after exposure is washed

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for a minute or two, and then immersed in a very weak solution either of potassium bichromate or of chromic acid. The strength of the solution, and the length of time the enlargement is allowed to remain in it, govern the extent of the action. Two grains of chromic acid in ten ounces of water will be found a very fair average strength for the purpose, and the enlargement, when made limp in the washing water, may be placed in such a solution for, say, three minutes. It is then washed in several changes of water for five minutes, and developed with the ordinary developer, fixed, and washed as usual.

The action of the chromic acid will be found to be a kind of holding back of the development of the darker tones, while the lighter ones are developing; and at the finish these darker tones should look just right when the high lights also are as they should be. If the enlargement looks too heavy in the shadows, when the lights are about right, it is a sign that the chromic acid solution should be stronger, or else allowed to act for a longer time. If, on the other hand, the enlargement is weak and wanting in contrast, it is a sign that the chromic acid treatment was overdone. It is not a matter for which any hard and fast rules can be laid down, as it is impossible to define in words the extent to which the reduction of contrast in any given case is to be carried. All that can be done is to proceed by actual trial; after one or two experiments the photographer gets to know the necessary strength to bring about what softening he requires.

COMBINING NEGATIVES.

The commonest form of combination or double printing is the printing in of clouds to a landscape from another

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negative, and this is not any more difficult in enlarging than it is in contact printing—in fact, it is generally easier. Different workers set about it in different ways, the methods being divisible into two: (1) Those in which the enlargement is developed once only; (2) those in which it is developed twice, with an intervening exposure. Of the two, the former is the easier, on the whole.

We will suppose that the photographer has a landscape negative with a sky which in the enlargement is a mere blank white, and a cloud negative which has suitable cloud forms to remedy the defect. The first step is to focus the landscape negative on the easel on a sheet of thin card, and then on that card with a sharp pencil to draw the sky line of the picture. The card is then taken down, and is cut in two along the pencil line. A piece of bromide paper is then pinned up on the easel, and exposed for the landscape. Without disturbing any of the arrangements, after exposure, a line is drawn on the bromide paper with a soft pencil to indicate where the sky line comes. This has to be done while the orange glass cap, which is a necessity in this work, is in its place on the lens. It must not be done before exposure, or when we come to clean off the pencil mark (as we shall do at the finish) we may find that the blacklead has protected the paper from light during exposure, and so has left a white mark, which it may be difficult to spot out neatly.

The cloud negative is then put into the enlarger, and is adjusted so as to come in exactly the position desired. This is done with the yellow glass cap in position, the pencil line on the paper showing where the landscape part of the picture lies. An exposure is made on the sky portion

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of the paper, shading the rest with the piece of card, keeping it moving all the time to prevent any hard line from showing. The enlargement is then developed and fixed in the ordinary way.

If the sky of the landscape negative is not sufficiently dense to keep the paper white, the other half of the card may be used to shade it during exposure. It will generally be necessary to give a trial exposure both to the landscape and to the sky portion, so as to make sure that both parts of the final enlargement are correctly exposed. There is, of course, no need for the two negatives to be of the same size; the degree of enlargement of one may be quite different from that of the other. If the sky subject is illuminated from the opposite direction from that of the landscape, it can be made suitable for use by putting the negative into the enlarger the other way round.

In putting skies into enlargements, there are two dangers which must be avoided. One is the formation of a light line, following the outline of the sky, and caused by unskilful manipulation of the mask. It is not possible to show in writing how this can be prevented; it is a matter of dexterity, with which some workers seem to be born, and which others acquire by practice. It would not be right to say that it is difficult to vignette the sky into the landscape properly, as many seem to find very little trouble in doing so; at the same time, there are some workers who seem unable ever to accomplish it quite satisfactorily. The other danger referred to is that of getting the sky too dark, or too strong in contrast for the rest, or what amounts to very much the same thing, getting the lights in the landscape too light. If the sky put in is exposed

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for too long a time, or if the cloud negative is too great in contrast, the result will be a very unnaturally stormy effect. If there are any very white parts in the landscape, and a sky is put in which is all delicate half-tone, the two parts of the picture may be in two different "keys," and the tonal falsity of the combination will at once be apparent. It will be seen then that to provide a landscape enlargement with a sky calls for more than the mere making of a good join between the two exposures; there must be harmony right through both, or the result will be a failure.

These remarks apply with equal force to the other method of putting in skies by developing twice over. In this case, the landscape is first exposed, and is then developed, stopping preferably a little short of the point at which development is complete. The enlargement is then washed as thoroughly as possible for ten minutes or a quarter of an hour, the surplus moisture taken off the face of it by gentle dabbing with a perfectly clean cloth, and is pinned up on the easel for a second exposure with the cloud negative. The visible image which has developed makes the adjustment of the second negative and the masking during exposure comparatively easy.

The wetting of the paper with developer and water reduces its sensitiveness very considerably, sometimes making it only one-fourth of its original speed; so that a trial exposure becomes a necessity. Moreover, the sensitiveness during the second exposure depends to some extent upon the way in which the first developer has been washed out; so that care must be taken to treat the trial piece and the piece finally exposed in precisely the same way. After exposure it is put back in the developer for

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the clouds to develop. The landscape portion will in all likelihood go on developing a little, but not to any great extent, since, as was shown in the chapter on development, there is a kind of pause in the action of the developer when it has fully developed a properly exposed image.

Some photographers, however, instead of putting the enlargement back into the dish to develop, leave it on the easel. It is exposed upside down, so as to bring the sky to the bottom, and is developed while in this position either during the actual exposure, or with the orange glass cap on, a brush being used. The developer has sugar or some other "mechanical" restrainer added to it to slow down its action; and, of course, is only applied to the sky portion, or, if to the landscape at all, it is applied in a diluted form, so as to blend the one image into the other without developing the greater part of the landscape to any appreciable extent further.

Methods similar to these may be used for other subjects when double negatives are necessary, and modifications of them to meet special cases will no doubt suggest themselves to ingenious minds. When the best result is to be got, however, there is no doubt that a combination of cloud and landscape in a pair of transparencies, which are then bound up together and used to make an enlarged negative, is to be preferred. The method of doing this is described in the Chapter which deals with enlarged negatives in general.

CHAPTER IX.

Trimming and Mounting.

TRIMMING.—A CUTTING SURFACE.—THE USE OF THE KNIFE.—DECIDING WHAT TO TRIM.—MOUNTING FOR FRAMING CLOSE UP.—CUT-OUT MOUNTS.—MOUNTING CARDS AND PAPERS.—SELECTING THE MOUNT.—MOUNTING ON CANVAS.—ADHESIVES, "HIGGINS'."—STARCH PASTE.—MOUNTING WITH PASTE.—RUBBER SOLUTION.—MOUNTING WITH GELATINE.—CENTRING THE ENLARGEMENT.—THE PREVENTION OF COCKLING.—DRY MOUNTING.

BROMIDE paper having a surface which is coated with gelatine cannot be dried in contact with anything, or it would stick to it and be spoiled. The surplus moisture may be taken off by dabbing both back and front of the enlargement with a cloth that is free from fluff, or by placing it between the photographic blotting-paper known as "Robosal" for a moment; this should only be done if the drying is to be hurried. The print is then either pinned up by two of its corners, or thrown over a line, or attached to it by clips to get quite dry.

The trimming cannot be done until the paper is perfectly dry, or it would drag under the knife, and tear. There is no difference between the trimming of an enlargement and that of any smaller print. If the size precludes the use of a cutting shape, the boundaries of the print should be carefully marked out in pencil on its face, making the pencil lines thin and accurate, and putting them so that the trimming knife just cuts them off. A sheet of card, or a sufficient thickness of newspapers, smoothed

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carefully out, makes the best surface on which to cut. It very soon blunts the point of the knife, but does not turn it, as cutting on zinc or glass will do.

Any perfectly flat straight piece of some material which the knife will not cut may be used as a guide. The best of all is a steel straight-edge, which can be bought a couple of feet in length for very little, and makes a most useful and lasting tool. It must be kept quite bright, or else when placed down on the bromide paper, it will leave a mark. The knife may be a pocket knife, or one of the "cobbler's knife" pattern sold specially for trimming. Its point should be kept as sharp as possible, or the cut will not be a clean one. The knife should not be held vertically in making the cut, but tilted so as to undercut the picture a little. This will then prevent a white line from showing all round the picture if it were put on a dark mount. If the sides of the cuts are at right angles to the face of the print, the line would show, and in some circumstances would be objectionable.

So much for the mere cutting of the edges of the print ; but the term "trimming" includes a great deal more than that. It should not mean so much in enlarging as it does in contact printing, because the enlargement may be made of any size at will, and the selection of that particular part of the negative which is to be included in the finished picture should be made before putting the enlargement in hand, so that the sheet of bromide paper may be fairly well filled with the subject that is to be shown in the finished picture, and there may be little waste by trimming down afterwards. Still, some trimming will have to be done ; and precisely what to leave in and what to cut away will require careful consideration.

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The first thing to be done is to get the enlargement to lie flat, and to do this it should be put, face downwards, on a clean piece of paper, a straight-edge held down on it, then drawn along from one end to the other, raising the paper with the left hand while holding the straight-edge with the right. If this is done two or three times in each direction, the print will be left with a little tendency to roll up with the picture outwards ; but this soon goes, and it will lie quite flat. Two pieces of thin card should then be cut into the shape of a very broad capital L, the two limbs of the L being respectively at least as long as the side and end of the enlargement. These two L's can then be laid down upon the face of the picture, so as to form a kind of frame enclosing it, and should be shifted about, first in one position and then in another, until there is no doubt that they enclose just that part of the picture which gives the most satisfactory result. When this is so, a light pencil dot is put at the four corners, and if the lines joining those dots are at right angles to each other, they may be ruled, and the print trimmed.

There is a very natural reluctance on the part of the photographer to cut off any more of his picture than he is obliged ; and as a consequence many of the enlargements that are seen are spoiled by the inclusion of too much. One of the commonest defects of the kind is to be seen in landscapes, where the upper part of the picture, intended to represent the sky, is quite the lightest tone in the whole subject, and this light tone runs right up to the edges. Strong high lights should never come on the edges of the picture, as they at once weaken it, by their tendency to lead the eye away from the true subject, which

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lies elsewhere. Moreover, the sky in an enlargement is often a mere blank white, and blank white will not represent sky, or anything else, faithfully. So that if there is any doubt about it, the knife may be used to trim the sky right off, or, better still, the image may be so adjusted on the bromide paper that none of the sky is included. If by means of combination enlarging, or in some other way, the sky is in proper tone with the rest of the picture, of course the need to trim it off will vanish.

When the subject of the enlargement is some moving object, such as a vessel, the trimming should be so carried out as to leave a space in front of it, so that the motion may appear into and not out of the picture. In the same way, if it represents a portrait, while the edge may be carried near to the back of the head if this seems desirable, an unpleasant effect results if there is not a certain space in front of the face. Important parts of the subject should never finish right on an edge; they should either terminate well within it, or else run clear out of the picture altogether. Nor should any important object appear to come right close up to three or to all four sides of the picture, as this gives a crowded effect, and suggests more than anything else that there has been a difficulty in getting the whole of the object into the picture.

These are a few general rules which may be of some use to the beginner, but they are little more than expressions of what good taste would show ought to be done; and if the photographer finds as he progresses that he still has to be guided by formal rules instead of by an innate sense of what is artistically right or wrong, he is not likely to achieve any great success, at least in pictorial work.

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The enlargement having been trimmed has to be mounted. If it is to be mounted for framing close up—that is to say, without any of the mount showing at all—it may be more convenient to mount it first, and then to trim it afterwards. The mount for such a purpose may be merely a stout piece of millboard on which the enlargement is stuck down; and then, after ruling pencil lines on it to indicate to the frame maker precisely what is to show in the opening of the frame, the actual cutting down of the mounted print may be left to him, as the excess beyond the ruled lines will depend upon the width of the rebate of the frame.

The same procedure may be followed when the enlargement is to be mounted behind a cut-out mount—a very effective method if it is to be framed. The character of the cut-out mount will be governed by the same considerations as when the enlargement is stuck down on its mount, which will be considered shortly. As a rule, the bevelled opening of the mount should not be gilt, but left either the natural colour of the card or black. A very fine material for a cut-out mount is the very thick paper felt, made for putting under carpets. It is generally a plain grey colour, which harmonises very well with the tint if an untuned enlargement; but it has the drawback that it is very difficult to cut with a neat bevel, the material being loose and fibrous.

Cut-out mounts with gilt faces, or faced with veneer, are not generally satisfactory. The pattern of the wood becomes assertive, and the gold makes the enlargement look weak and poor. It is best to have the opening in a cut-out mount cut by a professional mount-cutter.

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Cards on which to mount enlargements are of the most diverse kinds. The big dealers list all sorts of designs for the purpose. Cards with "India tints"; cards with a plate mark; cards with embossed or printed patterns; cards with other cards stuck on them; and so on, through a variety almost infinite. For certain purposes such mounts are no doubt very suitable; but for the amateur who wishes his mount to be nothing more than an adjunct to his enlargement, they are not so well fitted, since the mount tends to attract attention to itself. Besides, all these mounts are necessarily designed to carry an enlargement of a certain standard size, and, as has been shown a few paragraphs earlier, each enlargement should be trimmed to suit itself, irrespective of any standard sizes whatever. So that it comes to this, that in most cases the best mount is merely a piece of plain card, neither very light nor very dark in tone, and of a colour and texture to harmonise as well as possible with the picture that is to be put down upon it.

There are many such mounts now available, most of the leading dealers listing a whole series. They go by a variety of names: "Art mounting boards," "Nature papers," "Æsthetique mounts," and so on; and can usually be purchased in two different thicknesses. For small sizes the thicker of the two is suitable, with the thinner being used to put between the mount and the print in "multiple" mounting; but for anything, say, of whole-plate size or larger, it is necessary to get the mounting papers themselves mounted on card. With a selection of such cards to pick from, the enlarger will have no difficulty in finding something to suit each of his pictures.

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The first necessity of the mount selected must be that it will harmonise in colour with the enlargement. Ordinary untuned enlargements are best mounted on cool grey or green prints, light or dark as the case may be. A brown or warm-toned mount will make the enlargement look too cold by contrast. On the other hand, a toned enlargement goes very well on a brown mount of the right shade, but there are brown and brown, and some of the brown mounts clash most unpleasantly with the colour of a toned print. Neither a white nor a black mount is suitable for pictorial work, being too assertive in itself ; but for scientific and other photography a white mount is suitable enough, and furnishes a means of making any needful notes concerning the subject of the photograph.

The texture of the mount is also important. If it is too smooth, it is apt to make the enlargement itself appear coarse, especially if the degree of enlargement is at all great. On the other hand, if it is very coarse, and the enlargement is on thin paper, the latter when stuck down will show some of the granularity of the mount, and the effect will not be at all pleasant. A middle course is what is wanted, and this is found in a plain matt surface, very much of the same appearance as that of blotting-paper or of brown paper, or in a surface with a fine grain or texture not unlike linen. Such mounts are easily obtainable.

For some purposes it is desirable to mount an enlargement on canvas. In such a case the grain of the canvas is sure to show. The canvas must first be strained upon the usual form of stretcher, and then the enlargement, while quite limp and damp with moisture, either from the mountant or by being wetted, is laid down upon it and

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rubbed down. The stretcher can then be picked up with the enlargement adhering, laid face downwards on a clean surface, and the rubbing continued on the back of the canvas until it is in good contact all over.

The actual mounting of an enlargement is not so easy as that of a small contact print, because the paper used is generally of a stouter character, and because of the area to be covered with mountant ; but it is not a difficult operation at any time, if a suitable mountant is used, and the enlargements are put under a little pressure until they are dry.

The mountants applicable are very numerous. When the mount itself is to be seen, it is easiest to use a mountant which will not stain the mount, in case any should work out. The prepared pastes, of which " Higgins' Mountant " is one of the best known, belong to this category. Such a mountant has greater adhesive power than any home-made preparation of starch.

If such an adhesive is not available, starch paste may be used. To prepare it, about a teaspoonful of starch should be crushed to powder and stirred up with cold water to make a thick cream. The stirring should be thorough, continuing until the mixture is quite uniform and free from lumps. It is then put into a basin a great deal larger than is needed to hold the cream, which basin should have been made hot beforehand by leaving hot water in it for a minute or two. Then, while stirring the starch, water which is *boiling* should be slowly poured on it from a kettle until the whitish mixture becomes almost transparent, and suddenly thickens. No more water than is necessary to bring this about should be used. A teaspoonful of starch generally requires nearly a pint of water.

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When the starch has gone cold, it should be squeezed through a cloth—an old cambric handkerchief does very well—and is ready for use at once. It will not keep in good order for much more than a day, and in fact the fresher it is the better ; but it should not be used until it is cold.

When one of these mountants, or starch, is being used, the enlargement is laid, face downwards, on a clean newspaper, and a little of the adhesive is well rubbed into the back of it all over. A stiff brush may be used, but a good many workers prefer the fingers, and they certainly tell better when the whole surface is uniformly covered. If the enlargement is on thick paper, a second coating will have to be given, as the paper itself will absorb all the moisture out of the first. Particular attention should be given to the edges, and especially to the corners, and the last thing before putting it down on the mount, those parts should be gone over again. The enlargement should be uniformly limp before putting it on the mount.

When this is the case, it is picked up, put in the desired position, the fingers quickly wiped, a clean piece of newspaper laid down over it, and every part well rubbed down with the fingers or with the flat of the hand, or else (what is certainly to be preferred) it should be rolled down with a roller squeegee. Here again attention must be given to the edges and corners. When it is seen to be in contact all over, a clean piece of paper should be substituted for the one through which the rolling has been done, and it should then be put away under gentle pressure to dry. The pressure may be given with a flat board and a pile of books or weights, or in a letter copying press or trouser press ; but there is no need to apply more than is necessary to

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keep the enlargement in good contact with the card while the adhesive dries.

Another mountant which is serviceable is made of rubber solution. The ordinary mixture sold for repairing tyres requires thinning down with at least an equal bulk of benzine. It is coated freely on the back of the enlargement, which is then put down on the mount rubbed into contact, and put aside for a day or two under pressure. Any rubber which works out at the edges can be rolled up and removed by gentle rubbing with the finger tip. The merit of rubber solution as a mountant is that it does not cockle the mount in the slightest; the drawback is that in time the rubber perishes, and the picture comes off.

Those who can use it without making a mess on the mount will find glue one of the most serviceable of mountants. It should not be the ordinary dark brown evil-smelling variety, but should be made of white sheet gelatine; or "Nelson's X opaque gelatine," as sold for cooking purposes, will be found to answer. The gelatine is allowed to soak in cold water for two or three hours, until perfectly soft right through, and is then squeezed up in the hand to get rid of any surplus water, and put just as it is into the glue-pot, which, if it has been used for ordinary glue, should have been well washed out. The outer vessel is then filled with cold water, and when this is boiling the glue is ready for use.

There are two ways of using this glue. One is to apply it to the back of the enlargement in the ordinary way with a brush, getting as thin and as even a coating with as little loss of time as possible, and then putting it on the mount and rubbing it down. The other is to fill a tin

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dish with very hot water, and to put on the top a sheet of glass. The top of this glass is then brushed all over with the glue, a thin even coating of a kind of gluey froth being given to it. As the glass is hot, this can be done deliberately. When it is seen to be coated, the enlargement is laid down on it, gently rubbed into contact all over, and then picked up and laid in its position on its mount, squeegeed, and put under pressure to dry. There is much less chance of any glue working out with this way than with the former, as the coating is much thinner.

It is very important to put the enlargement down in exactly the right position on the mount straight away. Any shifting of one on the other is sure to result in messing up the mount with paste. The position, therefore, should be marked out beforehand. A pencil line on the mount showing where one edge of the enlargement should come, with clear indications where the two corners on that edge are to be put, is all that is required ; nothing is gained by marking it all round. The edge is then carefully placed so as just to conceal the marked line, and the print lowered until it is in contact all over.

There is another dodge for putting a print in position on a mount, which may be worth description. A board is wanted a little larger than the mount, and on this board, along two edges, two strips of wood should be fastened so as to form an exact right angle. A piece of stout paper, or a mount the size of the mount to be used, is taken, and on it the precise position of the enlargement is marked in pencil. The enlargement being duly pasted is laid face downwards on the marked portion of the mount, which is then laid on the board, pushed up into the angle formed

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by the strips, and then the actual mount itself is pushed into that angle face downwards, brought down on to the enlargement, pressed into contact, picked up, turned over, and the rubbing down done in the usual way. Where a number of enlargements all alike are to be mounted on similar mounts, this device effects a considerable saving of time.

The cockling of mounts is a great trouble with some workers. With any adhesive containing water, such as most pastes, it is quite impossible to prevent cockling, except by mounting in a corresponding position on the back of the card a similar piece of paper to the enlargement on the front. But it can be minimised by taking care that the enlargement is not really wet when it is laid down—in fact, that it is as nearly dry as is consistent with it sticking. If this is done, and if the mounted picture is allowed to dry under pressure, cockling will not be troublesome.

There is a beautiful mounting process which does away with cockling entirely—the dry mounting method. Unfortunately, it is not available for amateur enlargers, as in big sizes it requires a powerful and costly hot press; but for small sizes, the apparatus is not very elaborate. For professional work dry mounting is the ideal, and leaves nothing to be desired.

CHAPTER X.

Toning Enlargements.

SULPHUR TONING.—PERMANENCE.—THE INDIRECT METHOD OF TONING.—BLEACHING.—THE SULPHIDE SOLUTION.—PRECAUTIONS TO BE TAKEN.—VARIATIONS OF THE PROCESS.—THE IODINE METHOD.—TONING WITH HOT HYPO-ALUM.—COLD TONING.—TONING WITH COPPER.—WITH URANIUM.—WITH IRON.—TONING BY MERCURIAL INTENSIFICATION.

THE colour of the image on a bromide enlargement is, or should be, a good clear black. For a few subjects it is possible to get a very suitable colour by using a modification of the pyro developer, which gives an olive brown image ; but with most workers, pyro leads to staining and unpleasant tints, and black is that generally sought for. Although this black is very suitable for most work, it is apt to tire, and variations from it are welcome. There are many such which can be carried out by toning the black image. Some of these give results of doubtful permanence, but others do not lessen the permanence of the bromide print ; they have even been said to increase it.

The most popular toning method for enlargements to-day is that known as sulphur toning or sulphide toning. It takes its name from the fact that to carry it out the black image on the paper, which consists of metallic silver, is converted into a brown one of silver sulphide. Silver sulphide is a very permanent substance, and there is no reason to suspect that a print in which the whole of the silver has been converted into silver sulphide is not as permanent as it was before. The colour of the image after

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toning varies from a yellow brown of a crude unpleasant character to a rich dark sepia, according to the quality of the enlargement before toning, and to the way in which the operation is carried out.

There are two distinct methods of sulphur toning. The first, or direct method, is by means of hypo-alum; the second, the indirect method, is one for which Mr. Blake Smith is largely responsible. In it the image is first converted into some salt of silver, which can be attacked by a soluble, sulphide, and then placed in a solution of such a sulphide, which completes the toning operation. The second method is the more widely used to-day, and so may well be taken first. It should be understood, however, that whether one method or the other is adopted, the final result, if the process is properly carried out, is the same, namely, an image consisting of nothing but silver sulphide.

The first operation is usually called bleaching, as it lightens the picture very much, although very few of the solutions employed completely bleach it. The bleacher in general use is one containing potassium ferricyanide and potassium bromide. A convenient stock solution is made by dissolving an ounce of potassium bromide and three ounces of potassium ferricyanide in ten ounces of water. This solution keeps fairly well, and for use is merely diluted with water. A suitable strength for use is one part of the stock solution to nine parts of water.

The print or enlargement to be bleached is placed in this after it has been fixed and well washed, and is left in it until the whole of the picture has lightened to a very weak brown—until, in fact, the action will go no further.

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It is of the utmost importance in this process to have the enlargement completely fixed and all the hypo washed out. Ferricyanide and hypo, as every photographer knows, form a powerful reducer ; and if any hypo were left in the paper, it would reduce the image, an effect which might not show at the time, but which would manifest itself by the final result being weak and of a poor colour. There is no fear of the bleaching action of this solution going too far, and it is important that it should be complete ; so the enlargement should not be taken out directly it seems to be done, but left in until there is no doubt about it. The enlargement may be put into the bleacher wet or dry ; the whole of the toning operations may be done in white light.

After bleaching, the enlargement has to be darkened with sulphide. It is usual to rinse it once or twice between the two operations, but a thorough washing is not required ; and, indeed, no great harm would result if it were put straight into the sulphide solution without any washing at all. The sulphide most usually employed is sodium sulphide. This is a salt smelling strongly of rotten eggs, and is chosen for this purpose because that smell is not so bad as that of some of the other compounds, which in other respects are just as suitable. "Pure sodium sulphide" should be bought, if the solution is to be made up by the user. It consists of greenish-white wet-looking crystals, which, if not kept in a very well corked bottle, soon turn into a watery mess at the bottom. The stock solution of sulphide, in a well stoppered bottle, keeps better than the salt. To prepare it a glass flask and a gas stove or Bunsen burner are required. An ounce and a

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half of the crystals are weighed out and put into the flask, and about ten ounces of hot water added. The flask is then put on the stove and the liquid boiled for at least five minutes. It is best to do this where the fumes can go straight up the chimney and out of doors, as they smell very strongly. After boiling, the solution is allowed to go cold, and then is either filtered through filtering paper or left to stand undisturbed for four and twenty hours, and is poured off any black sediment which may be found deposited at the bottom. The clear solution is diluted with water to make twelve and a half ounces, and may then be put into a well stoppered bottle, and labelled "Twelve per cent. solution of sodium sulphide."

The working solution is made by taking half an ounce of this to ten ounces of water. The bleached enlargement is put into this, and at once begins to darken. The darkening may take place very irregularly at first, so that one might think that the picture was spoilt. But if it is given time enough, the parts that did not darken at first catch up to the rest, and the print looks quite even again. As with the bleaching, the darkening must be allowed to go on until the action seems to be able to go no further ; and even then it is well to leave it in for a minute or two longer. The washing after toning should be of the same character and thoroughness as that after fixing.

It is important not to use the sulphide solution at any greater strength than that just mentioned, as it has a powerful effect upon gelatine, softening it, and tending to produce blisters. For the same reason, the face of the enlargement should not be touched while it is in the sulphide bath or in the subsequent washing water, as it becomes

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very tender. The dilute sulphide solution should be thrown away after use. There is no need to use a fresh lot for each enlargement, provided it is not exhausted, and the rate at which the darkening takes place will indicate this sufficiently. The sulphide solution at once blackens any white paint it may reach, it blackens the lead of the sink, and attacks metal generally, so that it must not be splashed about. It smells strongest after it has been poured down the sink ; but a good deal of the smell can be prevented by pouring down after it some water in which a few grains of potassium permanganate have been dissolved.

The most frequent defect in this method of toning, apart from any blistering (to which reference has already been made), is a poor colour. This may be due to the original enlargement being unsuitable. Brown is never so dark as black, and if the enlargement, when the image is a black one, is only just deep enough to appear satisfactory, it is sure to look too pale when its blacks have been converted into browns. The enlargement which tones best is one in which the deepest shadows are distinctly strong, and even the highest lights show some slight trace of deposit. If the action has been properly carried out, such an enlargement when toned will be of a deep sepia, almost a brown-black, and very rich in colour. Most of the toned enlargements which are to be seen appear as if they were hardly strong enough before toning to do the method justice ; and as a result, the colour is a brown rather than a brown-black.

The solution of sodium sulphide gradually decomposes, and one of the products of decomposition is hypo. Hypo has an immediate reducing action on the bleached image, so that if the sulphide has begun to decompose, the enlarge-

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ments will be weakened. This is one cause of poor, yellow-brown tones.

There are several variations of this process which may be mentioned. The original bleaching solution recommended by Mr. Blake Smith is a little more trouble to use than the one just described, but it certainly gives excellent results. It consists of a solution of iodine in potassium iodide solution. To make it up, two hundred and twenty grains of potassium iodide and ninety grains of iodine are put into a measure with an ounce or two of water, and stirred up at intervals. The dark mixture is then diluted with water to make a pint. It should be put in a stoppered bottle; it will keep quite indefinitely, and may be used over and over again. With use it gradually loses its colour, and more iodine may be added to bring it back to its original tint and strength. The fixed and washed enlargement, wet or dry, is placed in this solution, and the paper rapidly turns a blue-black, on which the image is at first invisible; but as it gradually bleaches, a *negative* image will be seen. The bleaching must be given plenty of time, as it is not possible to tell by looking at the enlargement at this stage whether it is complete or not. The enlargement is transferred direct from this bath to a freshly made five per cent. solution of sodium sulphite. This bleaches the blue-black paper completely, and at this stage only the very faintest traces of a picture, if any, should be visible on the paper. If the darker parts of the picture are found not to be completely bleached, the enlargement should be rinsed once or twice, and put back into the iodine solution to complete the operation. The sulphite must be allowed to act until there is no trace of blue colouration left in the paper;

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and the enlargement is then transferred to a solution of sodium sulphide similar to that described a few paragraphs earlier. It is darkened in this, and washed in the way already set forth.

Although in theory this bleaching solution should give pictures identical in every respect with those which the other yields, in actual practice the author has found the tones obtained with the iodine bath deeper and richer than with ferricyanide and bromide. The sulphite bath means a little extra trouble, but the process seems to be worth it.

There are other bleaching solutions which answer very well; and those who do not mind the smell may use ammonium sulphide instead of sodium sulphide. This is a liquid, which keeps much better than the sodium sulphide, and only needs dilution for use. One dram of the sulphide to ten ounces of water is a serviceable strength. There are "tabloid" and other preparations sold for this process; but as the makers in each case give the necessary working instructions, there is no need to describe the details of their use.

So far, the methods of sulphur toning that have been described are those which are known as "indirect methods." In the "direct method," as the term suggests, the enlargement is merely placed in a solution which turns the silver image into one of silver sulphide.

The only bath which is used for this purpose is one which consists of hypo and alum dissolved in water; and the method is therefore often known as the "hypo-alum" method. Its introduction was due to the Kodak Co., who were largely instrumental in popularising it. There are two ways of using the hypo-alum toning bath—the cold

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and the hot, the latter being that which is commonly employed.

To make up the hypo-alum bath, an ounce of alum is dissolved in a quart of hot water, and when dissolved ten ounces of hypo are added, a little at a time, the mixture being stirred the while with a strip of glass. It is then diluted to make eighty ounces all told, and a spoiled enlargement, or the trimmings of a number of gaslight or bromide prints are put into it, and left for forty-eight hours, after which it may be bottled off in a "Winchester" (an eighty-ounce narrow mouth stoppered bottle) until it is required for use. The solution is not a clear one—a sediment forms and settles; and when any of the bath is required for use, it should be shaken up so that some of the sediment is taken also.

The enlargement to be toned, after having been fixed and washed, should be allowed to dry. It is then hardened in a plain alum bath (alum one ounce, water one pint) for ten minutes. The author prefers this; but some workers omit the alum bath at this stage, although one will be needed later on, and put the enlargement direct into the cold toning solution, leaving it in that for five or ten minutes to harden before raising the temperature.

An enamelled iron dish may be used for the toning, but a porcelain one is better. A tin dish an inch or two larger each way than the porcelain one will be required. This should contain a layer of silver sand an inch and a half deep, and the porcelain dish should be bedded in this, so that it will get hot gradually, and there will be no risk of breakage. The whole arrangement may be put on a gas or oil stove, and a thermometer should be provided

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to make sure that the necessary temperature is not exceeded. Into this dish enough of the hypo-alum solution to cover the enlargement easily should be poured, the picture being immersed in it and turned over once or twice to make sure it is thoroughly wetted. It should be left lying face upwards during toning, and should not be allowed to cling to the bottom, or it may get too hot and the coating melt. The stove is lighted, and the temperature of the solution gradually raised to 120° F., at which it should remain until the toning is complete. The time required is generally about twenty minutes.

The enlargement is then transferred to a cold solution of alum, of the strength above mentioned, in which it should be left for five minutes. After the lapse of this time, its surface may be very gently wiped with a tuft of cotton-wool to remove a kind of scum which will be found upon it, and nothing remains but to give it a good washing, say in half a dozen changes, allowing five minutes for each.

Instead of toning quickly in a hot solution, the toning may be done in a cold one, but it takes a good deal longer. The enlargement should be put into a dish with sufficient of the hypo-alum solution to cover it properly, and after turning it over once or twice, may be left face downwards to tone undisturbed. Twenty-four hours is generally sufficient for the purpose, but more may be given if required. If at the end of the twenty-four hours, parts are toned more than the rest, the enlargement is not spoiled ; and if it is left for a further time in the solution, the untuned parts will catch up the rest. There is no need to alum the picture after cold toning ; a wash completes the operation.

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The hypo-alum method has the merit of cheapness, a great quantity of the stock solution being made for two or three pence. It should not be stinted. One of the most frequent defects is uneven toning, one print not being the same colour as another. This is due to the use of the same solution more than once. It is better to take a fresh lot for each enlargement, and to take plenty of it. More than one can be done at a time by the hot process if there is room in the dish ; but they should not be allowed to overlap. Overlapping in cold toning does not seem to do any harm. If the hypo-alum bath shows any tendency to reduce the prints, which it may do, especially in the direction of dissolving out the more delicate half-tones, it is a sign that sufficient clippings or spoiled enlargements were not put in at first to mature it. If there are none available for the purpose, five or six grains of silver nitrate dissolved in half an ounce of water may be added to the contents of the Winchester for the same purpose.

Hypo-alum toning will give the same rich sepia colour that is obtained by the sodium sulphide process. Both these methods are very suitable for use with bromide paper of which the base is tinted. A sulphur toned enlargement on cream paper is one of the most effective ways of printing one's best negatives. No attempt must be made in either case to carry the toning part of the way only. It is not like the gold toning of p.o.p., which is a kind of plating of the image with gold, and may be stopped whenever the action has gone as far as is wished. This is a substitution process, converting the metallic silver into silver sulphide. The untuned bromide image is a permanent one, if the operations have been properly

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carried out ; and the silver sulphide image, there is every reason to suppose, is also permanent. But when the image does not consist wholly of the one or of the other, its unalterability is by no means assured. However, it is not easy to carry out the process incompletely, so that there is not much temptation to do so.

There are a great many more methods of toning, of which only a very few can be dealt with here. A process of copper toning, due to Mr. W. B. Ferguson, K.C., is noteworthy for the very fine colours which it will yield. There has been some doubt cast upon the permanence of copper-toned prints, particularly on those in which the toning has not been allowed to go very far ; but, apart from this, the process has much to recommend it.

Three stock solutions are required for copper toning, and each may be a ten per cent. one. That is to say, an ounce of the salt, as bought, may be dissolved in seven or eight ounces of water, and then diluted to make ten ounces all told. (It may be as well to point out that this is not strictly a ten per cent. solution, but is quite near enough for all ordinary photographic purposes.) The three substances to be dissolved are neutral potassium citrate, copper sulphate, and potassium ferricyanide. Eight or ten times as much of the citrate solution is wanted as of either of the others. The toning bath is made by taking an ounce of the citrate solution, and adding to it seventy minims of the copper sulphate, and then sixty minims of the ferricyanide solutions. The mixing must be done in that order. If the mixture is not quite clear, a little more of the citrate may be added.

The enlargement to be toned must be properly fixed

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and washed, and may then be placed, wet or dry, in the toning solution. It is preferable to apply it to the dry print. Almost immediately the colour begins to change, altering first to a warm black, and then through various shades of brown and red until it reaches a kind of brownish pink, beyond which it cannot be toned. The action must be stopped by washing when the colour is what is wanted ; and there is no loss of colour or alteration afterwards. Four or five changes of water are sufficient, and the toning is finished.

As a general rule, it is the more lightly toned prints by this process which are the more satisfactory, those which have their black colour just warmed by a very slight application of the toner being particularly effective. Some vignettéd portraits, however, are greatly improved by being toned as far as the action will go, so as to get a kind of red chalk effect. The richness of the blacker tones is greatly enhanced by waxing (see page 133), and this is said also to act as a protection against any action which an impure atmosphere might have upon the enlargements.

This method is toning with copper ferricyanide. The ferricyanide of other metals may be used in a similar manner. The best known of these processes is uranium toning—a method which gives a wide range of fine colours, but which lies under a more or less well deserved stigma on the ground of want of permanence.

Uranium toning requires two stock solutions : One of a quarter of an ounce of uranium nitrate, half an ounce of glacial acetic acid, in three ounces of water ; and the other of a quarter of an ounce of potassium ferricyanide and half an ounce of glacial acetic acid in three ounces of

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water. These solutions keep fairly well separate, but the toning solution as applied to the enlargement cannot be kept. It is made by taking half an ounce of the uranium nitrate solution, a quarter of an ounce of the ferricyanide solution, and ten ounces of water.

The enlargement, which must be well fixed and washed, is placed in this, and toning begins at once. If only a sepia tone is wanted, the solution may be much more dilute, which effects an economy in the uranium nitrate—a rather expensive salt. The action is to alter the black to a sepia, then to a warm brown, and, finally, if it is allowed to go on long enough, to a yellowish red. On the whole, the series of colours obtained with uranium is very similar to that which copper will give; but the latter are, as a rule, the pleasanter. The uranium toning bath slightly intensifies the enlargement, but the action is not very marked.

The uranium compound which is deposited on the enlargement is slightly soluble in water, so that if the toned pictures were washed for a sufficiently long time, all the warmth would be washed out of them, and they would go back to their original black and white condition. This solubility is increased by any alkalinity in the water, so that the addition of a very little sodium carbonate to the washing water will enable the whole of the toning to be washed away very quickly if it is desired. To prevent this during the washing which is a necessity after toning, it is usual to wash the enlargements in water to which a little acetic acid has been added. A dram of glacial acetic acid to the quart of water is quite sufficient; and when the toning has gone far enough three or four changes of this water, followed by a couple of baths of plain water, allow-

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ing not more than a minute or two to each, will be sufficient.

In order to ensure success in uranium toning, the fixing and washing of the enlargement must be complete, and it should not have any tendency towards heaviness in the shadows. The ferricyanide used should be clean, ruby red crystals ; if it looks at all powdery, the crystals should be rinsed in cold water for a moment. Great care must be given to secure absolute cleanliness of the dishes, measures, etc. ; and it is all the better to let the enlargement dry before toning, and to give it a few minutes in a clearing bath (alum one ounce, citric acid half an ounce, water a pint), followed by washing in several changes of water for a quarter of an hour. It may then be put in the uranium toning bath. It is quite practicable to tone enlargements by this method with cotton-wool or a sponge. The wet print is laid face upwards on a clean sheet of glass, a ball of cotton-wool is dipped in the solution and quickly applied all over the surface. The cotton-wool must be kept moving all the time of toning, wetting it with fresh solution whenever necessary. This reduces very considerably the quantity of toning bath required.

Blue tones may be obtained by toning the enlargements with iron. The toning bath for this purpose is best made up as it is required. A number of formulæ for the purpose will be found in the different books of reference. A typical one is that in which the toning bath is made by dissolving ten grains of potassium ferricyanide and eight grains of ferric chloride in half a pint of water to which twenty or thirty drops of hydrochloric acid have been added. The fixed and washed enlargement is placed in this until the desired colour is obtained, and is then

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washed in four or five changes of water for a quarter of an hour.

An untuned enlargement which is not quite deep enough may be greatly improved both in vigour and colour by intensifying it, in the same way that a negative is intensified, using mercury ammonia for the purpose. When all the hypo has been thoroughly washed out, the enlargement should be placed for a quarter of an hour in alum half an ounce, water twenty ounces. It is then washed in three or four changes of water, and is bleached, either slightly or thoroughly, according to the extent of the strengthening action that is required. The bleaching bath is a saturated solution of mercuric chloride to each ounce of which two or three drops of hydrochloric acid have been added. After bleaching, it must be washed in three or four changes of water, then in three or four changes of hydrochloric acid half an ounce, water twenty ounces, and then in three or four changes of water again. It is then darkened in liquor ammonia one dram, water ten ounces, washed in three or four changes of water, and dried.

This exhausts the list of the commoner toning processes, but there are many others. It is not necessary, nowadays, to mix up the various toning baths required, as several makers put ready-made preparations on the market, which greatly facilitate operations. It may be pointed out that any toning bath which can be applied to a print or enlargement on bromide paper is equally applicable to gaslight paper, although the colours obtained on the one are generally slightly different from those given by the other.

CHAPTER XI.

Spotting and Working Up.

SPOTTING.—THE USE OF THE PENCIL.—REDUCING OUT BLACK SPOTS.—SPOTTING WITH THE BRUSH.—WORKING UP WITH BLACKLEAD POWDER.—THE USE OF CRAYONS.—PREVENTING RUBBING.—STEAMING ENLARGEMENTS.—WAXING METHODS.

THE photographic side of the process finishes when the enlargement has been mounted ; but few are so perfect that they cannot be improved by a little handwork. How much should be applied will depend upon the taste of the photographer. The professional enlargements are often very lavishly worked, so that of the visible image quite as much is due to crayon, or pencil, or brush, as to photography. To the photographic eye, which at once detects the presence of such handwork, these things are distasteful ; and it is seldom that the amateur has any desire to produce them. But a little work, which will improve the enlargement without suggesting the presence of anything that is not photographic, is not so objectionable. Then, again, even the greatest purist admits that spotting is permissible.

Spotting is the name given to the process of concealing any little spots which may show on the mounted enlargement. If these are black spots they have to be taken out either with a sharp knife or with ink-eraser ; and as, in either case, the surface of the enlargement is interfered with, it is better to avoid black spots as much as possible. To do this, the negative should be "spotted" before enlarging,

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every pinhole, except the very smallest, being stopped up by just touching it with a fine brush containing a little water colour. Ivory black is as good as any, and in order to prevent the colour running on to the parts of the negative round the spot, the brush should be almost dry. The spots will then be white on the finished enlargement, and are dealt with much more easily.

When the enlargement has any black spots on it, and the knife or other mechanical means of removing them seems undesirable, they can be taken out by reduction. A crystal of copper sulphate about as big as a filbert is dissolved in an ounce or so of hot water, and an equal quantity of potassium bromide is added. By just touching the spot with a fine brush dipped in this solution it will disappear. It should be applied to the dry enlargement, and very little should be used. If one application does not bleach the spot, it should be blotted off, and a fresh lot applied. When all the spots have been treated in this way, the enlargement must be placed in clean hypo solution of the ordinary strength for two or three minutes, and then may be washed free from hypo, and dried.

White spots may be toned down either with water colour or with pencil. Special pencils are supplied for spotting bromide prints; but a good ordinary HB or H will do all that is wanted. It must be kept finely pointed, and applied gently so as not to form a depression on the surface. An enlargement spotted with pencil may have all its spots perfectly concealed when looked at in the ordinary way; but when looked at obliquely each touch with the pencil is visible, looking shiny. Some people object to this, and prefer to use a brush for spotting, as

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it does not leave a shiny mark ; but the shininess can be removed entirely by steaming the enlargement, as described later on.

Spotting with a brush is a very simple operation, when once the slight knack of having the brush sufficiently dry and the colour sufficiently weak has been acquired. Ordinary water colour, or the special sets put up for the purpose, may be used, and a little is mixed up to match the colour of the enlargement. Black is all that is wanted for an untuned enlargement, but those that have been toned will need an admixture of sepia, vandyke brown, etc. The author uses for spotting sulphide toned bromide prints a special water colour which is supplied by the Autotype Co. for spotting carbon prints that have been made on "cool sepia" tissue. It is an exact match for a well toned print, without any alteration or addition whatever.

The colour being mixed to match the enlargement, the brush should be moistened with water, just touched with the colour, and then tried on a piece of white paper, drawing it along the paper in the direction of the handle, and turning it round so as to keep it pointed. In this way almost all the colour should be taken out of the brush, and then, when it has nearly ceased to make a mark at all, it is ready for use. The slightest touch on the enlargement should cause the white spot to disappear, toning it down to its surroundings. It is best to use the colour fairly strong at first, taking out all the spots that are in the darkest parts, and so need a good deal of colour to make them match. Then the colour is diluted, and the next lot are toned down, and so on, until the very slightest tone on the white spot causes it to match the tone round it. But whether it is to

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be light or dark, the brush must be almost dry. For the lightest spots there will be no need to get any fresh colour on the brush at all; it will suffice to dip just the tip of it into water, and twirl it on the paper until it leaves a faint discoloration only.

The process is easy enough, but if the spotting is to be carried very far, and especially if the enlargement has been great, so as to magnify into visibility all the tiniest defects of the negative, it may be tedious. If the enlargement is to be examined in the hand, or mounted in a book, it is well to spot even the smallest defects; but if it is to be put under glass and hung on a wall, there is no need to deal with those that are very minute, as they will not be noticeable.

What is known as "working up" an enlargement is more elaborate. The author has had no experience of this kind of work, so will give a few extracts from an article by Mr. Raymond Deane which was published in *Photography and Focus*. "The simplest form of working up," writes Mr. Deane, "is done with blacklead powder and a stump or cotton-wool. Not only can we take out defects in the enlargement; we can add a background of a simple kind with these materials without much difficulty. For instance, a single figure may have been taken out of a group either by blocking out the negative or by painting body colour on to a print over the parts not wanted, and photographing it. The former method gives, of course, an absolutely white ground, the latter one of some even tint, according to the tint of the body colour selected. In either case something to break up the evenness may be wanted; and this is easily supplied.

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“The surface is first prepared by sprinkling pumice powder over it, and then going over this with the palm of the hand with a circular grinding motion. This gives the enlargement a tooth, and when the powder has been dusted off with a clean duster, it is ready to take the work we may choose to put upon it. A little finely powdered blacklead and pumice powder are mixed in the proportion of about two of the powder to one of the lead. The mixing should be done by sifting them together through a piece of fine muslin on to a sheet of white paper, and there must be no lumps perceptible. A little tuft of cotton-wool is dabbed lightly on the powder, and is then applied to a sheet of paper, and it will be seen at once that by giving it a light circular movement, an even tint of a grey character can be applied just where we like. The cotton-wool is then rubbed on the enlargement in the same way, and it will be found quite easy to give the background a clouded effect, which will relieve its blank monotony. The success of the treatment, even in unskilled hands, is quite surprising; but practice and taste give a still better result. The beginner will find that he cannot do this without encroaching on the face, but that does not matter in the least; in fact, it is better to let the work go over the face, as then there is less chance of it giving the impression that the face has been avoided. When the work is finished, it is quite easy to take any off the face with the point of a piece of rubber.

“This mixture of blacklead and pumice powder may be lightened or darkened by varying the proportions of the ingredients, and may be applied to other parts of the enlargement that require it, either with the wool, or with the tip of the finger, or with a stump. It will be found

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very useful for strengthening the shadows in clothing, and for toning down lights. If the enlargement is at all inclined to be hard, a cloth with a pattern may have that pattern very pronounced by the harshness of all the highest lights on it, and a rub over with the powder will in such a case make a wonderful improvement. Any highlights which we want to leave as such are picked out afterwards with the rubber.

“Any fine work that is to be done on enlargements is best done in pencil. Water colours may be used, and the final result is better; but they are much more difficult to apply, and the beginner will ruin many prints before he succeeds in improving them with paints; whereas with pencils this is much easier. Special pencils are supplied for the work. The writer uses Hardtmuth's ‘Black Chalk’ crayons, which can be bought in the form of cedar pencils, or preferably in a holder with refills. There are several grades made, No. 3 being perhaps the best for a beginner. The pencil must be brought to as fine a point as possible by twirling it on a piece of glass paper, and the point must be kept in this condition by frequent applications to the glass paper. The first use to be made of the pencil is to take out any little defects in the shape of white spots. The enlargement, which should have been rubbed over with the pumice powder, is gone over carefully, and each spot evened down to the level of its surroundings by the point of the pencil. When the spots are larger than the head of an ordinary pin, it is best not to attempt to fill them with lead, but to tone them down by a series of fine lines, close together when a dark tone is wanted, further apart when it is to be lighter. It is much easier to get an

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even tone by shading in this way. It does not matter if, on looking into the work as the photographer bends over it, he can see the separate lines of his pencil ; they will not be noticed when the picture is glazed and hung on the wall.

“If there is any danger of work which has been done getting rubbed with the hand while other parts are being dealt with, a sheet of paper should be gummed to the top edge of the mount at the back, brought over and allowed to come down over the front of the enlargement, and holes cut in it to allow of the work being done as required. But it must be lifted up frequently to make quite sure that anything that is being done is in harmony with the general effect. When shading has to start along a perfectly straight line, or along a regularly curved one, a piece of thin paper may be cut out to the line required and held along the edge at which the shading is to start, so that the pencil strokes can start on this paper and then pass off on to the enlargement exactly where required. The paper must not finish actually on the line, but a very small fraction of an inch before, or the pencil lines will not begin exactly where they are wanted. A piece of paper may also be used to protect parts from the ink-eraser, and in this way one can rub out right up to a definite line.”

When any quantity of work has been done on the face of an enlargement, it is well to “fix” it, so as to allow the enlargement to be cleaned, if necessary in the future, without any risk of removing the handwork, and so as to give it a uniform surface on which the shine of blacklead or the dulness of the water colour will not be noticed. The enlargement may be sprayed with “fixatif” by means of a scent spray, the “fixatif” being of the liquid kind which

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is used by water colour painters, and obtainable from any artists' colourman.

A simpler method is to steam it. This is done by holding it in a good strong jet of steam from the mouth of a kettle. It must not be put so close that the coating melts altogether; a trial with a waste strip, preferably a piece trimmed off the actual enlargement itself, will show how much it will stand, and something just short of that should be given. Generally, it will be found that it can be held about two inches from the spout when the water is boiling very rapidly. It must be kept moving the whole time, so that the steam does not play on one part for more than a moment; and after about half a minute or more, according to the size of the enlargement being treated, it will be finished. The steaming softens and slightly melts the surface, allowing it to absorb the colour or blacklead that has been put upon it. The enlargement after steaming is merely put aside for a few minutes to get quite dry, and is finished.

There is another operation often applied very successfully to a mounted enlargement—that of waxing. Special preparations are supplied for the purpose, consisting mostly of white wax and a solvent; and these may be used in accordance with the instructions given by their makers. Those who have not any such preparation handy will find what they want in the mixture of beeswax and turpentine used for domestic purposes. The turpentine should be plentiful, so that the mixture is about as liquid as a thick cream. A little of this is well rubbed into the face of the enlargement with a clean rag, and the turpentine is allowed to evaporate. It is a good plan, an hour or two after apply-

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ing the wax, to hold the enlargement in front of a good fire for a few moments, so as to melt the wax, and then to put it aside where no dust will get to it, to cool. This will take out any streaks left in applying it. The waxing gives a very rich appearance to the enlargement, especially to the shadows. There is no advantage, however, in waxing a print on a glossy paper.

CHAPTER XII.

Ozobrome and Bromoil.

OZOBROME.—ITS ADVANTAGES.—THE TWO METHODS.—
MATERIALS FOR OZOBROME.—THE FIRST METHOD :
DEVELOPMENT AND FIXING.—THE SECOND METHOD :
RESTORING THE ENLARGEMENT.—BROMOIL.—THE
NEED FOR SKILL.—THE OZOBROME SOLUTION FOR
BROMOIL.—THE ACID BATH AND ITS INFLUENCE.—
PIGMENTING.

NO treatise on enlarging can be considered complete which does not deal at least in some brief form with two methods for altering entirely the character of bromide enlargements, the "ozobrome" and "bromoil" processes.

The ozobrome process, the invention of Mr. Manly, has for its object the obtaining of what is to all intents and purposes a carbon print by mere contact with the enlargement. A carbon print, as most photographers know, is one of the most permanent forms of photograph. The picture consists of nothing but gelatine and some selected pigment, so that if the pigment chosen is a permanent one, the carbon print made with it is permanent also. This is only one advantage, however, and there are others. The pigment may be of any colour, so that the image, without any toning or after process of any kind, may have any colour that the photographer selects; he may make his pictures in blue or green, in bright red or deep purple, in olive or in sepia, just as readily as in black. Moreover, he can have them on paper that is rough or smooth, white, cream, or tinted, just as he likes. These are the main

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advantages of the carbon process, and they are fully possessed by the ozobrome process also ; and it only remains to be seen how prints of this kind can be made from bromide prints or enlargements.

There are two distinct ozobrome methods, the materials for which are supplied by the Ozobrome Company. The first or "non-transfer" method is perhaps the simpler, so we will deal with it first. The requisites are the enlargement, a sheet of "pigment plaster," some ozobrome pigmenting solution, and one or two dishes, etc. The "pigment plaster" is paper which is coated on one side with a mixture of gelatine and pigment of the colour selected ; it is, in fact, "carbon tissue."

The enlargement which is to be turned into a carbon print by the ozotype process, which, by the way, requires no daylight, and may be carried out without a dark room, must be hardened with alum or formaline. A bath of formalin one part, water nine parts, applied for ten minutes when the washing is complete, and followed by a couple of rinses in plain water before drying, will answer the purpose. The dry enlargement is placed in cold water to soak until it is limp. A piece of the pigment plaster is placed to soak in the "ozobrome pigmenting bath"—a solution which can be purchased either in the form of a concentrated stock solution, or in tabloids. The pigment plaster, after a couple of minutes in this solution, is placed in very weak hydrochloric acid for about ten seconds. The strength of the acid and the time during which the pigment plaster is left in it are important. Strong hydrochloric acid diluted with ten times its bulk of water may be regarded as the stock solution, and one ounce of this to twenty-five ounces

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of water forms the correct strength for use. If the ten seconds are exceeded, the picture will have its contrasts reduced ; if the time is lessened, they will be increased. The pigment plaster is taken out of the acid, drained for a few moments, and then placed in the water with the enlargement ; the two are brought into contact, face to face, are taken out and gently squeegeed together with a flat squeegee. They are left in contact for about twenty minutes.

So far, the two ozobrome methods are alike ; they differ from this point onwards. In the method we are considering, the enlargement, with the pigment plaster adhering to it, is placed, after the lapse of twenty minutes, in water which feels just warm to the hand (105° Fahr.), and is left lying in this for a minute or two. It will then be found that the paper backing of the pigment plaster can be pulled right off, leaving a messy looking layer of gelatine and pigment lying on the face of the enlargement. The paper that is stripped off may be thrown away, and the face of the enlargement gently laved with the warm water. Gradually the pigment and gelatine wash away where they are not required, leaving behind a picture in the colour chosen. The original picture which lies underneath has become almost if not quite invisible, as the action bleaches it, and the visible picture should consist entirely of the pigment and gelatine. When the washing out has gone as far as seems desirable, the picture should be given a rinse in cold water and be hung up to dry. After drying, it is best to place it in clean hypo for a quarter of an hour, to get rid of the bleached original image which lies underneath, and then half an hour's washing will remove most of the hypo and

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leave the finished picture. As this does not consist of silver, but of some selected permanent pigment, the complete removal of the hypo is unimportant.

The second ozobrome method has the advantage that several ozobromes in the same or in different colours may be made from a single bromide enlargement, which, moreover, is not necessarily injured in the process. The enlargement for this method should not have been hardened in formalin or in alum. After it has been left for twenty minutes in contact with the pigment plaster, the two are put into cold, not warm, water, and are gently pulled apart. The pigment plaster does not seem to be altered, although actually it contains the picture. A piece of paper coated with gelatine only, and known as transfer paper, is soaked in cold water, and when limp the pigment plaster is squeegeed into contact with it, and the two are put under gentle pressure for a quarter of an hour. They are then placed in warm water, as above described, the backing paper of the pigment plaster is peeled off, and the picture is developed on the transfer paper, rinsed in cold water, and dried. No hypo bath in this case is necessary.

The enlargement, when the pigment plaster is peeled off it, will be found to have been bleached, although not so completely as to render the image invisible. It may be washed for ten minutes or a quarter of an hour, and then put into a non-staining developer of the ordinary kind, such as amidol or metol-hydrokinone, in which it will gradually come back to its original condition. There is no need to fix it again ; but when the development is complete, it may be dried and mounted, or may be used to make another ozobrome, and so on so long as it will hold

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together. It is quite easy to make half a dozen from one enlargement, the only limitation being the strength of the paper on which the enlargement is made, the constant wetting and pulling about finally injuring it so much as to make it no longer serviceable.

Such is the ozobrome process in outline. For further details of it, the special instructions issued by the Ozobrome Co., of Weedington Road, Kentish Town, London, N.W., should be consulted. The pictures which it gives are in every way the equals of those obtained by direct carbon printing in the ordinary way, and the long range of colours and the choice of surfaces given by the selection of different transfer papers, together with the permanence of the finished result, should commend it to those who want something more than the ordinary bromide enlargement.

BROMOIL.

A process which has recently come into considerable favour for exhibition purposes is known as bromoil, and is based on the ozobrome method just described, although in detail it differs very widely from ozobrome, both in the manipulations and in the results. Bromoil is in no sense a beginner's process, and, as commonly worked, it can hardly be regarded as pure photography at all; since its great recommendation in the eyes of those who use it is the power it gives of diverging, at least in tone values, from those of the original photograph. In very skilful hands, when the worker not only has manual dexterity, but also artistic knowledge, the bromoil process gives very beautiful results; but the power of "control" is so great, the print is so completely off the rails, so to speak, that without such knowledge and skill the results are anything but a success,

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and are often ludicrous in their departure from photographic and from artistic truth.

In the bromoil process the enlargement, which must be rich and strong in character, is fixed, washed, and dried in the ordinary way. It is then placed in a mixture of a special form of the ozobrome pigmenting solution, which is supplied by the Ozobrome Co. for the purpose, with alum and citric acid. The following formula is that given by Mr. Welborne Piper, who originated the process :

Ozobrome solution	..	..	..	1	ounce
Ten per cent. solution of potash alum	1			„	
Ten per cent. solution of citric acid			$\frac{1}{4}$	„	
Water	..	..	..	5	ounces

This dilute solution may be used to bleach two or three enlargements, one after the other, but it will not keep. The enlargement in this gradually bleaches, though the image never quite disappears, and when the bleaching is complete, it is quickly washed in two or three changes of water, and then left for about five minutes in dilute sulphuric acid (one part of acid to twenty parts of water). The length of time during which the enlargement is left in the acid will vary with different papers and the temperature. Mr. Piper gives two minutes as the minimum ; some workers find five minutes at least to be necessary. The appearance of the picture is a guide, as it should stand out in distinct relief from the surface of the paper when the acid treatment is complete ; and by holding it up and allowing it to drain, it will be seen if this is the case. The higher the temperature, the weaker should be the acid bath, so as to give this relief with as weak a bath as possible.

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After washing in two or three changes of water, it is placed in a solution of two ounces of hypo and half an ounce of sodium sulphite in a pint of water, and is then washed again in three or four changes of water for about ten minutes, after which it is ready to be pigmented.

The treatment which the enlargement has undergone has left it with its surface in a very curious condition. If it is blotted or wiped free from any surface moisture, and is then dabbed with a brush charged with a very stiff greasy ink, such as is used in lithography, it will be found that where there was an image originally, some of this ink will adhere, and that, within limits, the quantity of ink that adheres is proportional to the depth of the original image. Those who know anything of the "oil process" will understand this condition without further explanation.

The photographer who is working bromoil, accordingly puts his enlargement on a pad formed of a few sheets of wet blotting-paper, as it is important to keep the paper moist, and then after gently wiping the face of it with a clean smooth handkerchief to remove the excess of water, he proceeds to dab the surface with a brush lightly charged with a suitable ink. Special inks and brushes are supplied for the process, with a wide range of colours, so that the worker has a good choice of materials. The deposition of the ink is only slightly controlled by the picture on the paper, and the photographer, or rather the "bromailer," will find that with one kind of touch he can make the paper take a great deal of ink, even if there is little or no image there; while with another he can even remove ink he has already applied.

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The subject of bromoil is much too wide to be dealt with in merely a chapter in a book on enlarging generally, and the brief sketch just given is provided more to let the reader know the nature of the manipulations than to teach him how to carry them out—a task for which the author's experience has not been sufficiently great to fit him. Those who think of taking up the method will do well, therefore, to get the excellent treatise, "The Oil and Bromoil Processes," by Messrs. Mortimer and Coulthurst, which deals at sufficient length with both to form a practical and reliable guide.

CHAPTER XIII.

Defects and Remedies.

BLISTERS.—THEIR PREVENTION.—WANT OF VIGOUR.—EXCESSIVE HEAVINESS.—YELLOW OR BROWNISH STAINS.—FOGGED PICTURES.—DISCOLOURED PAPER.—CIRCULAR WHITE SPOTS.—STAINS AFTER DRYING.—POOR GREENISH OR RUSTY TONES.—STREAKY SURFACE MARKINGS.—STRESS MARKS.

SOME workers seem to be troubled very much with blisters, which generally make their appearance either during fixing or in the subsequent washing ; while others never meet with them at all. In some cases, there seems to be no doubt that the water supply is at fault. It may be that the water is highly aerated ; but a commoner cause is the bringing of the cold water pipe near one conveying hot water, so that the water used is either too warm, or, what is a more fertile source of trouble, is of varying temperature. Hypo, as it dissolves, lowers the temperature of the water considerably, so that a freshly mixed fixing bath is much colder than the water in which the enlargement may be lying. If warm water is used to dissolve the hypo, it may be too warm instead of too cold. Putting the print in solutions at different temperatures produces blisters.

Solutions which attack the gelatine may also give rise to the same trouble. Developers made up with caustic alkalies, or very strong in carbonate, solutions containing sodium sulphide or ammonium sulpho-cyanide, have this effect. Hence the amidol developer, in which neither caustic

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alkali nor carbonate is used, should be employed, if blisters are troublesome; and if the enlargement is to be sulphide toned, it should be hardened in alum or formalin beforehand.

If the hypo bath is too strong, and a print full of this strong hypo is placed direct in plain water, blisters may be caused by the irregular transfusion which takes place between the water and the hypo. In such a case, the hypo bath should be used weaker. It is doubtful if there is ever any advantage in using a stronger solution of hypo than one of two ounces to the pint, although twice this strength is more often employed. If the stronger solution is a necessity from any cause, and it is found to give rise to blisters, the paper may be put after fixing direct into a solution of hypo of half the strength used for fixing; and after a couple of minutes in this may then be placed in the plain water, so that the strength is gradually let down.

A preventive of blistering is hardening the film, for which purpose either alum or formalin is used. In the ordinary way the hardening bath is applied when the enlargement is fixed and washed; but if it is used to prevent blisters it must be applied before the stage at which they arise. A bath of formalin one part, water ten parts, may be given before fixing. The enlargement should be washed in at least two changes of water for five minutes, and may then be placed in the formalin for two or three minutes, and then rinsed and fixed. The application of formalin to an enlargement developed with amidol, without first washing out the developer, is almost sure to degrade the high lights.

Alum may be used instead of formalin. A solution of one ounce of alum in a pint of hot water is allowed to go cold, and is bottled off for use. It keeps indefinitely, and

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may be used over and over again. An enlargement containing alum must never be put into hypo, nor one containing hypo into alum, or its permanence will be affected, and its colour will very probably be altered. A good washing, therefore, say in half a dozen changes for at least a quarter of an hour, should be interposed between the alum and the hypo treatment. Instead of ordinary or "potash alum," chrome alum may be used. This is a more powerful hardening agent, and a solution of a quarter of an ounce of chrome alum to the pint is quite strong enough.

Although these hardening agents are preventives of blistering, it is much better to avoid them whenever possible, or at least only to apply them to the enlargement just before pinning it up to dry. If blisters give trouble, when a standard make of paper is being used, with the developer recommended by its makers, the proper course to pursue is not to try and dodge them, but to find out their cause and to remove it.

When the prolonged action of the developer fails to bring up a picture of proper contrast and strength, it is a sign that the exposure has been insufficient. This is shown particularly by the lighter parts, which remain white, or merely discolour. There is no remedy for such a state of things. All that can be done is to make a fresh exposure. When the want of vigour is perceptible all over the enlargement, the lights not remaining much whiter than the rest, but the whole being grey and poor, the developer is too weak. It may have deteriorated so as to have lost its strength, or dilution may have been carried too far. In the case of amidol, the use of a stale solution of sulphite has this effect.

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It may be, of course, that the want of vigour is due to the negative being too thin to give sufficient contrast. In such a case the following method, which is given by Messrs. Wellington and Ward in their handbook, will be found very suitable. The enlargement is exposed in the ordinary way, taking care that the exposure is full, and it must be developed as long as there is any increase in depth perceptible, regardless of any darkening over of the high lights. In fact, it should appear very much over-developed. After fixing and washing, it is placed in the following reducer until it is distinctly lighter :

Potassium iodide	..	..	..	30 grains
Water	..	..	..	10 ounces
Iodine ..	..	..	..	3 grains

It is then put straight into clean hypo. If the reduction has not gone far enough, the hypo must all be washed out, the iodine solution applied again, following this with hypo and washing, as before, until there is a risk of making the deepest shadows too grey. The iodine solution gives the whole print a blue colour, but the hypo discharges this. Negatives which are too thin to use for enlarging in the usual way can be made to give quite bright results by this treatment.

Enlargements which are very dark and heavy all over are over-exposed. They may be improved a little by reducing them with the ordinary ferricyanide and hypo reducer, but are never so good as if the exposure had been correct in the first instance.

Yellow stains which make their appearance in the fixing or washing, when a developer containing hydroquinone has been employed, are due to insufficient washing

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between developing and fixing. With other developers this is not so likely to occur ; but irregular brown stains sometimes appear in fixing or washing, which are due to the oxidation of the developer. If the enlargement is allowed to float on the surface of the hypo, or of the earlier washing waters, the formation of such stains is favoured. They will never arise if each enlargement is treated separately, rinsed well after developing, rocked, and kept well under the surface during fixing, and kept immersed and moving during the first two or three washings. After that there is little risk of them.

These stains in bad cases cannot be removed ; but when only slight, a thiocarbamide reducing solution will get rid of them. The enlargement must be fixed and well washed, as the solution will not act while there is any trace of hypo in the film. The bath consists of—

Thiocarbamide	..	..	..	20 grains
Citric acid	..	..	..	10 „
Water	..	..	..	$\frac{1}{2}$ pint

After the clearing has taken place, the enlargement should be washed for at least a quarter of an hour in five or six changes of water.

Fog, as distinct from stain, is a veil or deposit over the enlargement, of the same material, silver, as the image itself. The most likely cause of fog is improper exposure of the bromide paper to light. It may be that the dark room light, although safe enough for developing the paper, is too bright to be allowed to shine direct upon the paper all the time it is being exposed on the easel. It may be that stray light escapes from the enlarging lantern, or that white light gets into the dark room in some way.

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Dust on the lens gives rise to a foggy picture ; and another cause is to be found in reflected light, especially if the negative in the enlarger, although dense itself, has clear edges. The author has seen an enlargement badly fogged from light from the lantern reflected from the sheet of card used for focussing, which had been left lying on the table just in front of the easel. It is a sound precaution to mask the negative temporarily before putting it in the enlarger. The mask need not go right up to the boundaries of the proposed picture, but should go far enough to keep down surplus light.

Besides light fog there is chemical fog, due to the developer being improperly made up. If a piece of the bromide paper is carefully protected from light until development (it may be a corner of the sheet with a piece of black paper pinned over it), and that piece is then found to be fogged, the fog is chemical and not light fog. Were the bromide paper of imperfect manufacture, it might be fogged. But if a standard make is obtained, and the developer given by the maker is used, there is no fear of fog from either paper or developer.

There is no remedy for a fogged enlargement, although if the picture is fairly vigorous, and the fog is very slight, a weak reducing bath of ferricyanide and hypo applied for a moment or two, and followed by a thorough wash, will improve matters. The reducer may be applied immediately after fixing and before washing.

If the bromide paper is visibly discoloured before exposure, it is useless ; but if the discoloration is only round the edges, the centre may still be used. The cause of this defect is very old or imperfectly stored paper. If

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it is kept where gas fumes can get at it, or where the emanation from sodium sulphide can reach it, discoloration soon sets in. There is no remedy.

Circular light spots are caused by air bells adhering to the paper, and so preventing the access of the developer. If the paper is properly soaked in water before applying the developer, there will be no trouble on this score.

It sometimes happens that some time after an enlargement has been made, weeks or even months it may be, brownish stains make their appearance near the centre of it, hardly ever near the edges. These are signs that the paper was not properly fixed. There is no remedy for stains of this nature.

It has already been pointed out that if the developer is used too often, or if it contains an excessive quantity of bromide, it will not give good black and white pictures, but will yield a rusty or greenish colour. A very similar result follows if the developer used is very stale and has deteriorated; an error in making up the solutions may cause a similar result.

If there is nothing much the matter with the enlargement beyond this poorness of tone, it can be put right by bleaching the image completely, well washing it, and then developing it again, taking care that for this second development a developer which is correctly made up, and not one that gives greenish tones, is employed. Mr. Blake Smith recommends as a bleacher---

Potassium bichromate	..	..	90 grains
Concentrated sulphuric acid	200 to 400 minims		
Common salt	1 ounce
Water to	10 ounces

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The prints are sufficiently bleached after five or ten minutes in this solution, and then are washed until all the yellow stain due to the bichromate has left them. If this cannot be removed in a quarter of an hour's washing in repeated changes, a bath of five per cent. alum may be given them.

The developer which he recommends consists of —

Metol	45 grains
Sodium sulphite crystals	130 ..
Sodium carbonate crystals	270 ..
Water to	10 ounces

No bromide should be added to this, and after this second development there is no need to fix the enlargement again.

If the finished and dry print shows any sign of streaks on the surface, these can often be removed by giving it a good rubbing with a ball of cotton-wool moistened with methylated spirit and squeezed almost dry. The darkening of the wool shows when anything is being cleaned off the enlargement, and unless the wool is *almost* dry, it will not have any effect. By prolonging the action, the parts rubbed can be reduced. It is best to rub the whole print, as the cotton-wool leaves the surface a little more shiny than it was before, and this alteration should extend all over, or it will be noticeable.

Papers with a glossy surface are sometimes subject to what are called stress marks—a form of defect more frequently found in gaslight than in bromide papers. Any pressure or scratching, which gives the coating any stress, even a slight one, may result in a dark patch or line developing where the pressure or scratch was given. A very slight touch will do it at times, even such as is caused by taking the sheet of paper out of the packet rather

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roughly. Different makes of paper differ considerably in their susceptibility to stress marks. The way to prevent them is, of course, to handle the paper carefully.

As a rule, stress marks are very superficial. The rubbing with cotton-wool and spirit, mentioned in the previous paragraph, will often get rid of them ; or, if preferred, the enlargement may be given a momentary immersion in a ferricyanide and hypo reducer immediately after fixing. A crystal of potassium ferricyanide the size of a pea is crushed up and dissolved in three or four ounces of cold water, and one ounce of this solution is added to about four ounces of the ordinary hypo bath immediately before use. The immersion must only be for a moment, or the delicate half-tones of the picture will be dissolved away and left a blank white.

CHAPTER XIV.

Enlarged Negatives.

THE ADVANTAGES OF ENLARGED NEGATIVES.—THE QUALITIES TO AIM AT IN THE TRANSPARENCY.—MAKING THE TRANSPARENCY ON A PLATE.—COMBINATION TRANSPARENCIES. — CARBON TRANSPARENCIES. — MAKING THE LARGE NEGATIVE.—WORKING UP THE NEGATIVES.—ENLARGED NEGATIVES ON BROMIDE PAPER.—ENLARGED NEGATIVES DIRECT FROM NEGATIVES.

THE simplicity and directness of bromide enlarging carry with them certain other advantages. Every process of reproduction from a negative involves some degradation of its tone values, however carefully it may be carried out. Thus if a print is made from a negative, and a fresh negative from that print, and then a print from the new negative, the second print will inevitably be inferior to the first. It will show what, for want of a better term, is often spoken of as a "loss of quality." The loss may be kept down by skilful photography, but still there must be some. When a bromide enlargement is made, the enlargement, like the contact print, comes straight from the original negative, and there is no more of this loss in one case than in the other. The directness of the production of a bromide enlargement is thus a great point in its favour.

There is another method of making enlargements, which has not this directness, but has other counterbalancing advantages, which make it very popular with workers of a more advanced type. In this, instead of the

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ordinary enlargement, which may be regarded as an enlarged print, an enlarged negative is made. This negative once obtained may be printed, just like an ordinary negative, by any of the processes which commend themselves. Thus, while carbon, platinum, and the ordinary printing-out papers are too insensitive to be used for enlarging in the ordinary way, enlargements can be made upon them by making an enlarged negative and then printing it.

The making of an enlarged negative involves two distinct processes: (1) The making of a positive transparency, and (2) the making, from the transparency, of the negative itself. The two need not be done at the same time—in fact, it is much more convenient to separate them, making one or more transparencies at one time, and then at some other making the enlarged negatives from them.

The easiest method of making the transparencies is by means of a dry plate. Either the ordinary plate, as used for negative work, is used, or else one of the special lantern or transparency plates. The latter give a prettier transparency, but the writer, when nothing else happened to be available, has made transparencies on very rapid orthochromatic plates, which gave just as good enlarged negatives as if they had been on transparency plates. Still, such material is not regarded as the most suitable, and if there are any number to be done, it is better to get the special plates for the purpose. They should be bought ready backed; the transparency of the coating on plates of this type makes backing very important.

Whether a rapid, an ordinary, or a transparency plate is selected, the method of use is the same. The negative, carefully dusted, is put in a printing frame, the plate laid

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down upon it, film to film, the back put in, and an exposure made, just as if it were a print on bromide paper that was in hand. The transparency plates usually require very much the same exposure that a piece of bromide paper would do ; but plates such as are used for camera work will be found to need a surprisingly brief one. Two or three seconds at three feet from an ordinary flat flame gas burner may be more than sufficient for a fast plate.

It is most important to get the best possible transparency, so that a trial exposure should always be made ; and if, after this, there is any doubt about the result being as good as can be got, another plate and yet another should be exposed. The trial should be made in much the same way as was described for making the trial exposure in bromide enlarging, covering first one inch of the negative, then another, and then another with a card, and then developing it to see which is correct.

The character of transparency most suitable for the purpose is not that which is aimed at in a lantern slide. A good slide should have ample density in its shadows, while its highest lights of all are nearly, if not quite, clean glass. For enlarging, this state of things is not suitable. The shadows should be quite as dense as in a good slide, but there should be none of that clearness in the high lights. The best enlarged negatives are made from transparencies which a slide maker would regard as distinctly over-exposed. When laid down on a sheet of print, the type should be clearly legible through the densest parts of the transparency, while there should be a distinct deposit, even in the very clearest. This deposit must be due to full exposure, and not to fog, of course ; and any parts of the

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plate which have been protected from light altogether should be perfectly clear glass.

The most suitable developer for transparency plates is that given in the makers' instructions. If ordinary plates are used, the developer should be a non-staining one. Amidol, made up exactly as recommended for bromide paper, answers very well; or one of the excellent single solution developers now on the market may be used. Given an exposure sufficient to provide the requisite deposit even on the highest lights, development may be full, so as to yield a transparency with a fair degree of contrast. After development, it is fixed, washed, and dried in the usual way.

It is not necessary to make the transparency by contact; it is advantageous at times to do so in the enlarger, when this is of the lantern type. If preferred, we may enlarge direct from the negative on to a plate the full size of the enlarged negative, and then from the large positive so obtained make a large negative by contact on another plate, or by the carbon process, to be described later. There is no advantage in doing so; but it is sometimes convenient to make the transparency in the enlarging lantern either the same size as the original negative or a little larger.

This method affords a very convenient way of making a combination print. Suppose, for example, that we have two negatives, one of a landscape and one of a cloud, which we wish to combine in a single enlarged negative. The first stage is to make a transparency of the landscape on as large a plate as the enlarging lantern or other enlarger will take. This is done by merely substituting for the bromide paper an ordinary or a transparency plate, which-

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ever is preferred. If the sky of the negative is not very dense, it should be shaded during the exposure, as we want to have it as near clear glass as possible. This transparency is developed, fixed, washed, and dried in the usual way. When dry, on the glass side of it some opaque paint is applied to all the more transparent portions of the landscape, if necessary going right up to the sky line ; but this is seldom required. When this paint is dry, the transparency is placed, film to film, in contact with a fresh plate, and the negative of the clouds being put into the enlarger, the second plate is exposed through the first, and is then taken away and developed. In this way, the first plate acts as a mask for the second, and when a satisfactory cloud transparency has been obtained, the paint is cleaned off the landscape, the two are bound up film to film in accurate register, and an enlarged negative is made from the two, just as if they formed a single transparency.

Although a dry plate forms the most convenient method of making a transparency, it is not the only one. The carbon process gives a better result than is possible on any dry plate, according to some workers ; and certainly many of those who are most skilful employ it. The best tissue for the purpose is that which is known as transparency tissue, as not only is the pigment in this more finely ground, but the proportion of it is larger than in tissues made merely to give paper prints. It is best to sensitise the tissue in pieces a little larger than, say, four times the size of the original negatives, so that when it is dry, the edges may be trimmed off, and the piece then cut up as desired.

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There is no better sensitising solution for carbon tissue than that known as Bennett's. This is made by dissolving half an ounce of potassium bichromate in twenty ounces of water. One dram of citric acid is then dissolved in five ounces of water, and the solutions are mixed. Finally, strong ammonia is added, a little at a time, until the red colour of the bichromate solution changes to yellow, for which about three drams will be required; but no more than is requisite should be added. The solution so obtained keeps well, and may be used over and over again. The tissue should be soaked in it until it is quite limp, say, for three or four minutes, and is then pinned up to dry in the dark.

A number of glasses will be required, and these, which may be spoiled negatives with the films removed by soaking first in cold and then in hot water, and scrubbing with a brush, must be prepared. To do this, after a thorough cleansing, for which purpose soap and water, followed by ample rinsing, answers well, the plates while still wet are immersed in a warm solution of ordinary gelatine fifty grains, potassium bichromate twenty grains, water five ounces. The gelatine should be soaked for an hour or two in the water, the bichromate should then be dissolved, the gelatine melted by standing the vessel in hot water, and the mixture strained through a couple of thicknesses of cambric. Sometimes the glass is repellent, and will not "take" the gelatine solution as it should; in such a case, a rub with a clean piece of rag dipped in the mixture is a remedy. The glasses, after coating, should be put in a rack to drain and dry, and should be left for an hour or two after they are dry in strong daylight.

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The tissue is exposed just as when making a carbon print, except that a longer exposure is generally required for a transparency. After exposure, it is placed in cold water together with one of the prepared glasses ; and as soon as it begins to uncurl, the tissue is squeegeed face downwards on to the glass and put aside, with a few pieces of blotting-paper on it, under gentle pressure for half an hour. It is then placed in water just as hot as the hand will bear quite comfortably ; and after the lapse of a minute, the paper of the tissue is peeled gently off, and the picture now lying on the glass is developed by laving it with the warm water. It is finished by being put for a quarter of an hour in a five per cent. solution of alum, washed in four or five changes of water, and dried.

This process gives very fine transparencies, and those who have not yet tried carbon printing will find it very attractive, and by no means difficult. The transparencies when dry often have curious markings on the surface, which it might be supposed at first would quite unfit them for their purpose. They do not seem to make much difference, however. They can be lessened by varnishing, and altogether prevented by turning up the edges of the tissue after exposure, so as to make it a kind of shallow dish, pouring into it some enamel collodion, pouring this off, allowing the collodion left on the tissue to set, and then wetting and squeegeeing it as described above ; but this is not actually necessary when the transparencies are only required for enlarging purposes.

The transparency made, by whichever process is preferred, the next stage is to make the enlarged negative from it. For this purpose it is put into the enlarger, and

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an enlargement made on a dry plate, very much in the same way as one is made on bromide paper. As one has usually to buy large plates specially for this purpose, the best to get are the "ordinary" or slow speed plates of one of the standard makes. They should be bought ready backed. The transparency should be put into the enlarger, so that the image as thrown on the surface of the plate appears reversed right for left, and it will then be the right way round in the final print. The one exception to this rule is when the enlarged negatives are to be printed by the single transfer carbon process, which itself reverses the result. So that then the picture on the easel should appear the right way round. The coated side of the plate, of course, is that which is turned towards the enlarger.

The exposure required by the enlarged negative can only be found by trial; but as the transparencies are, or at least should be, all very similar in character, and as the light, when artificial light is employed, is uniform, when once a trial plate has been exposed and one or two enlarged negatives have been successfully made, there should be very little trouble in determining the correct exposure in any particular case. Although the large plates are comparatively costly, it is very poor economy to try and do without a trial plate at first, or to judge the correct exposure with a trial plate of small size of the same make. If a glass cutter is at hand, one of the big plates may be cut lengthwise in two, so as to serve for a couple of trials, but anything smaller than this is likely to be misleading.

The developer used may be the one recommended with the plates, or that which is generally employed for negative work. The slow plates employed are generally amenable

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to any developer without trouble. A point which will need very careful attention is the extent to which development is to be carried. The plate being slow, plenty of red light may be used and the development watched by holding up the plate to the light. The developer for the trial plate should be mixed up very carefully, and its temperature taken before use. The time required to develop the plate should also be taken, and fresh developer used for each plate. So long as the developer and temperature are the same, the time of development necessary will be the same.

The watch or clock is a very valuable aid in enlarged negative making, because the photographer accustomed to develop small plates may very easily go astray in judging the density of big ones. From the greater separation of the most dense from the most transparent portions, their apparent contrast is lessened, and so to the eye accustomed to judge the density of small plates, the enlarged ones look much weaker than they really are. The tendency at first, therefore, is towards over-development, and the negative which looks just right turns out on being printed to be too strong in contrast. One soon learns to judge them, however, and the difficulty vanishes.

The greatest advantage of an enlarged negative is the facility it offers for making prints, in any process, from a negative, which may have been worked up to give the effect desired. For this purpose, the glass side of the negative is coated with matt varnish, or with thin tissue paper, and on this with stump, brush, or colour, as much hand-work as the photographer thinks that it requires may be applied. There is a fine kind of tissue paper known as *papier mineral*, which is stocked by most of the larger

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photographic houses, which is very suitable for this purpose. A sheet of the paper the size of the negative is taken, floated for a few moments on a dish of clean water, and is then carefully blotted on both sides, and laid down on a smooth surface. The edges of the glass side of the negative are then given just a thin coating of gum, and the plate is laid down upon the damp *papier mineral*. This adheres, the negative is picked up, the paper lightly pressed into contact with the gum all round, and without any attempt being made to stretch the paper flat, it is placed on one side to dry. As it loses its moisture, the paper contracts, so that the layer is beautifully smooth when dry, and is then ready for the handwork. Parts which are to print darker may have the paper cut away, or it may be made more transparent by painting a little oil on it; but as this work applies equally to negatives that are not enlarged, any detailed description of it would be out of place here.

Although for making enlarged negatives an enlarging lantern or else a form of daylight enlarger (in which the work is done in the dark room) is a convenience, it is not a necessity; and very good enlarged negatives may be made in a fixed focus daylight enlarger by substituting a transparency for the negative, and a dry plate for the bromide paper. It is sometimes an advantage in such a case to make the transparency in the enlarger, making the negative from it by contact.

Some workers, instead of making their enlarged negatives on glass plates, use ordinary bromide paper for the purpose. It answers very well, but, for reasons into which there is no need to go, the exposure has to be determined very

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carefully, the paper not having the latitude in this respect that is possessed by the plate. The advantages of the paper for the purpose are cheapness, absence of risk of breakage, and the ease with which handwork can be applied, either to the front or to the back, whichever is desired.

The paper causes such negatives to print more slowly than negatives on glass ; and it gives to the prints a slight grain, which, in the case of enlargements, is not marked enough to be in any way a drawback. The paper can be made more translucent by treating it with wax or Canada balsam. A suitable mixture for the purpose is made of one part of Canada balsam to five parts of turpentine, which is lightly brushed over the paper side, and allowed to dry. It is better not to use it, however, or to make any attempt to make the paper translucent, as some papers do not take it uniformly all over, and in that case the negative is useless until the whole of the balsam or wax had been washed out of it again with benzine.

At different times many attempts have been made to obtain enlarged negatives direct from negatives without the intervening transparency. The process in theory is simple enough. The layer on a sheet of bromide paper consists of silver bromide in gelatine. After exposure and development, it contains an image of metallic silver ; but until it is fixed, in addition to the image of metallic silver, there is a quantity of undeveloped silver bromide, and the quantity of this is inversely proportional to that of the metal. Thus in the high lights of an enlargement, where there has been very little picture developed, there is a great deal of silver bromide unaltered, while in the deepest shadows where the image is strongest, a great proportion

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of the silver bromide has been turned into metallic silver, and there is very little unaltered silver bromide left. When we place the enlargement in hypo, it dissolves the unaltered bromide, leaving a positive image of silver. If, instead of hypo, we used some solution which dissolved the silver, but did not touch the silver bromide, we should have a negative image of silver bromide. As silver bromide is almost the same colour as the paper, it would only be faintly visible, but if we exposed it to light and then applied a developer to darken it, it would become visible enough. There are such solutions, and several methods have been suggested.

They are all subject to the drawback that there must be a good quantity of silver bromide on the plate or paper to start with, and even with a full exposure and full development, only a comparatively small proportion of it is developed into metallic silver, so that even in those parts of the enlarged negative which should be most transparent, there is a good deal of silver bromide left, and this, darkening in the developer, makes the negative very dense and opaque.

Those who wish to try such a method, which will yield quite promising results, may make an enlargement on bromide paper, giving a very full exposure, quite twice what would be required in the ordinary way, and carrying on development until even the highest lights have darkened over decidedly. The developer should not be thrown away, but poured back into the measure, the enlargement washed for a minute or two, and then, without fixing, it should be placed in a solution of potassium permanganate, acidified with sulphuric acid. A convenient strength is

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permanganate twenty grains, water thirty ounces. When the permanganate is dissolved, but not before, one dram of sulphuric acid is added. In this bath the image which has just been developed very rapidly dissolves, and the paper, except for the colouration of the permanganate, soon appears almost as white as ever. It is then washed once or twice, taken into daylight, and the developer poured on again, and allowed to act until the negative image which it develops is dense enough. The enlargement is then rinsed, fixed in hypo in the usual way, washed, and dried. Any stain left by the permanganate can then be removed by giving it a bath of oxalic acid ten grains, water one ounce, washing, and drying.

Before leaving the subject of enlarged negatives, a word should be added on their appearance. The perfectly crisp, flawless character of a first-class negative taken direct must not be expected in an enlarged negative. Every minute defect in the original negative is magnified in the enlarged one. There is also some falling off in the definition, inevitably. There may also be a certain degree of granularity from the enlargement of the very texture of the small negative ; while, as we have already seen, it will look less dense than it really is. Such an appearance should not disappoint its producer. Any coarseness or granularity will not show in the print, and slight defects will also disappear if the paper on which the print is made is not too smooth in texture. The greater the degree of enlargement, the rougher may be the texture of the print to advantage. There is a little falling off in quality, inevitably, as we have already seen ; but this should not be noticeable unless a print from the enlarged negative is

ENLARGED NEGATIVES.

put side by side with a direct enlargement of the same size. It is said that carbon transparencies lead to less falling off than those made on dry plates, but the difference is not great at the most. On the whole, when the great power of modifying the result both in the production of the transparency and of the second negative, and the wide diversity of printing processes that are available, are considered, the method of enlarging by means of an enlarged negative is one which is almost sure to be selected by the photographer, when he has mastered bromide paper work, and wishes for something which will give him greater scope.

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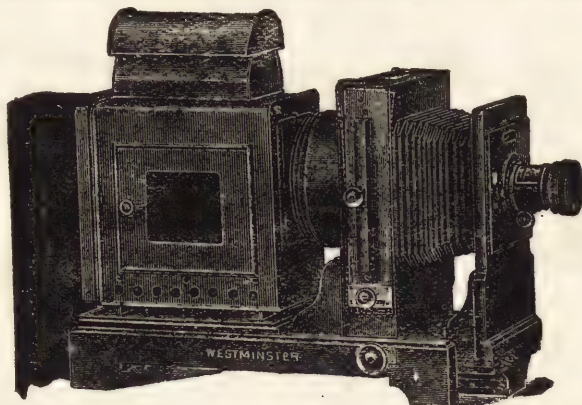
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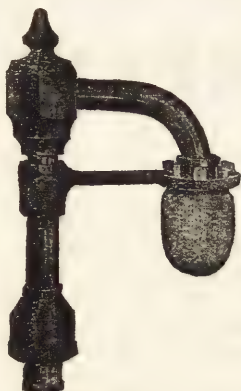
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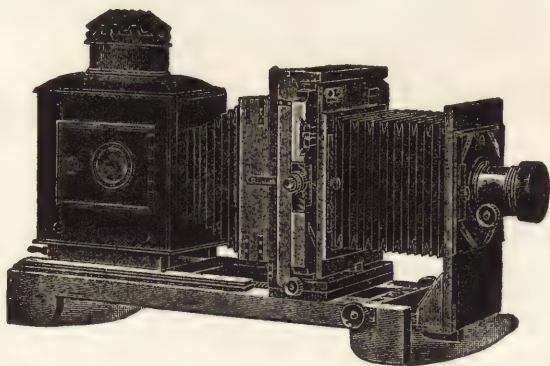
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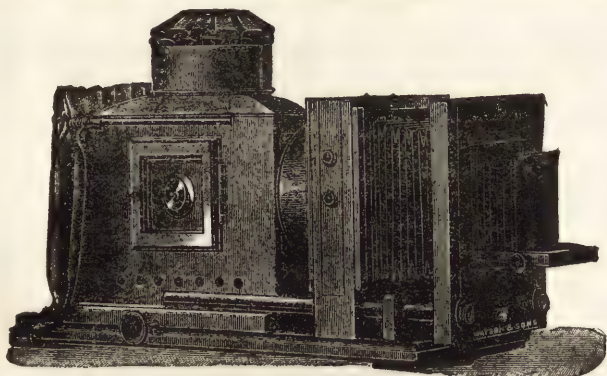
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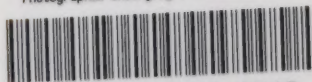
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